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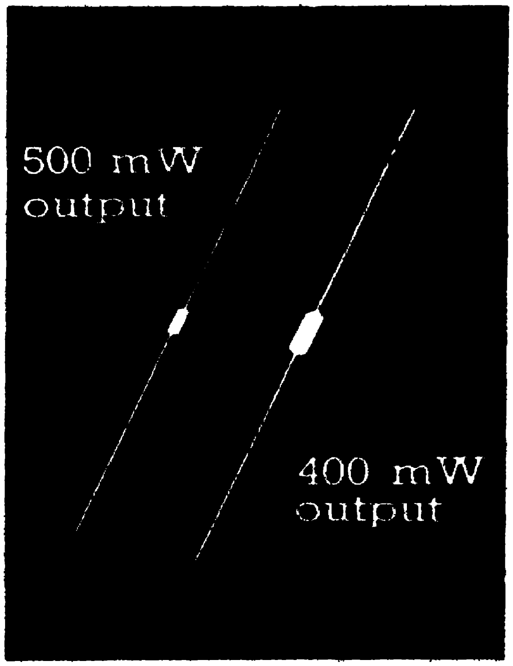

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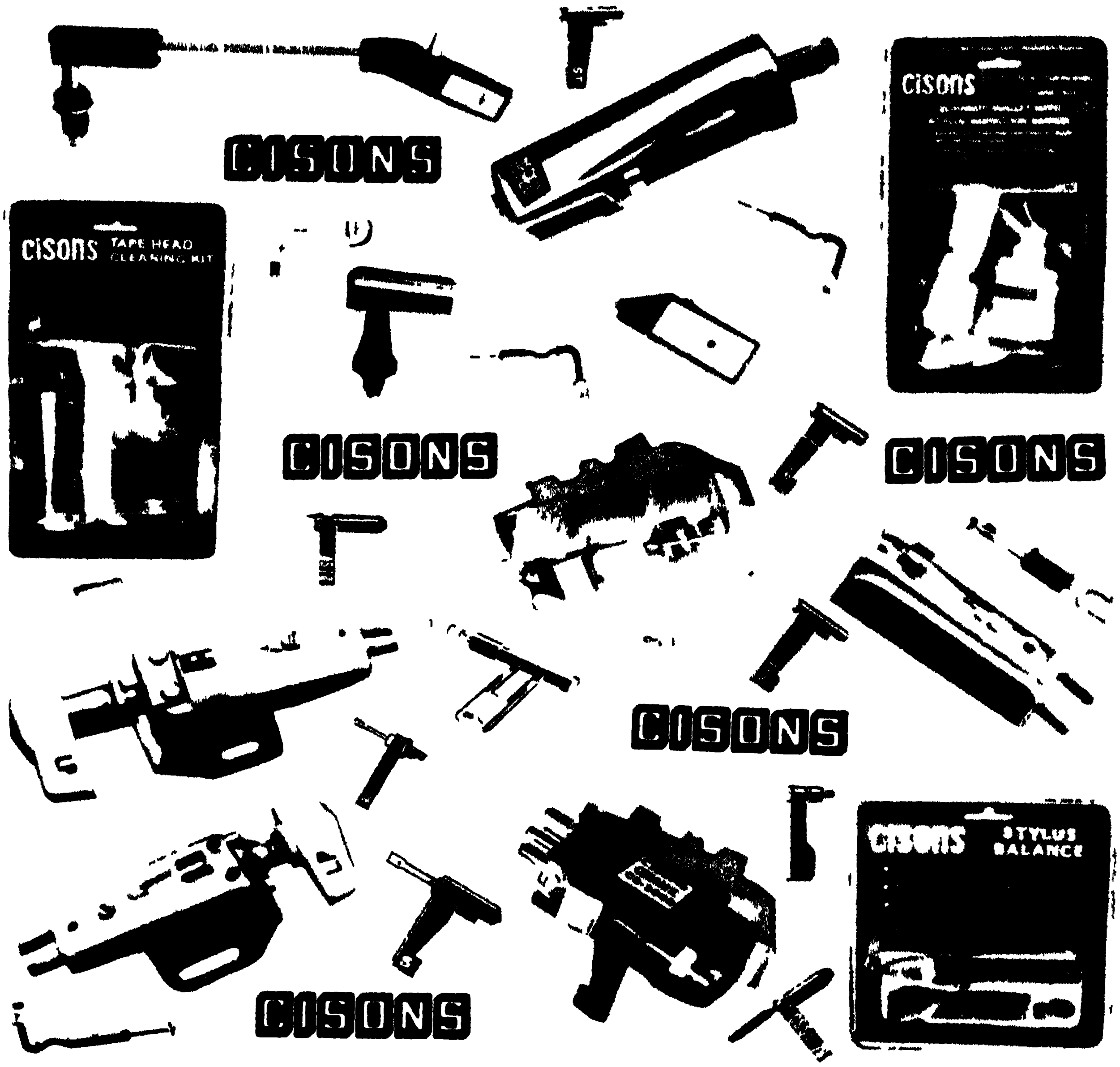

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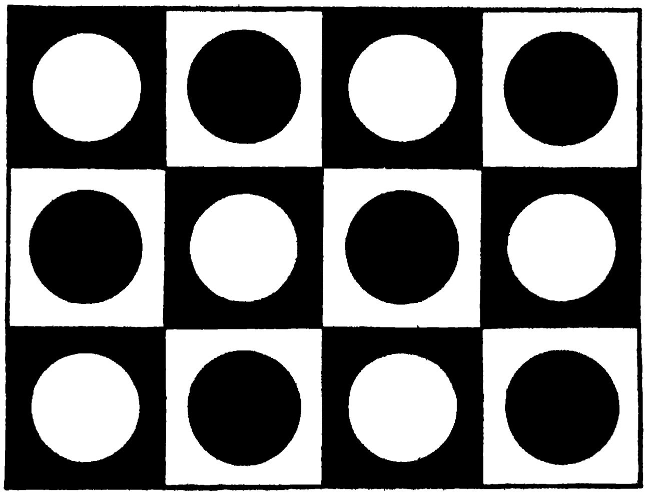

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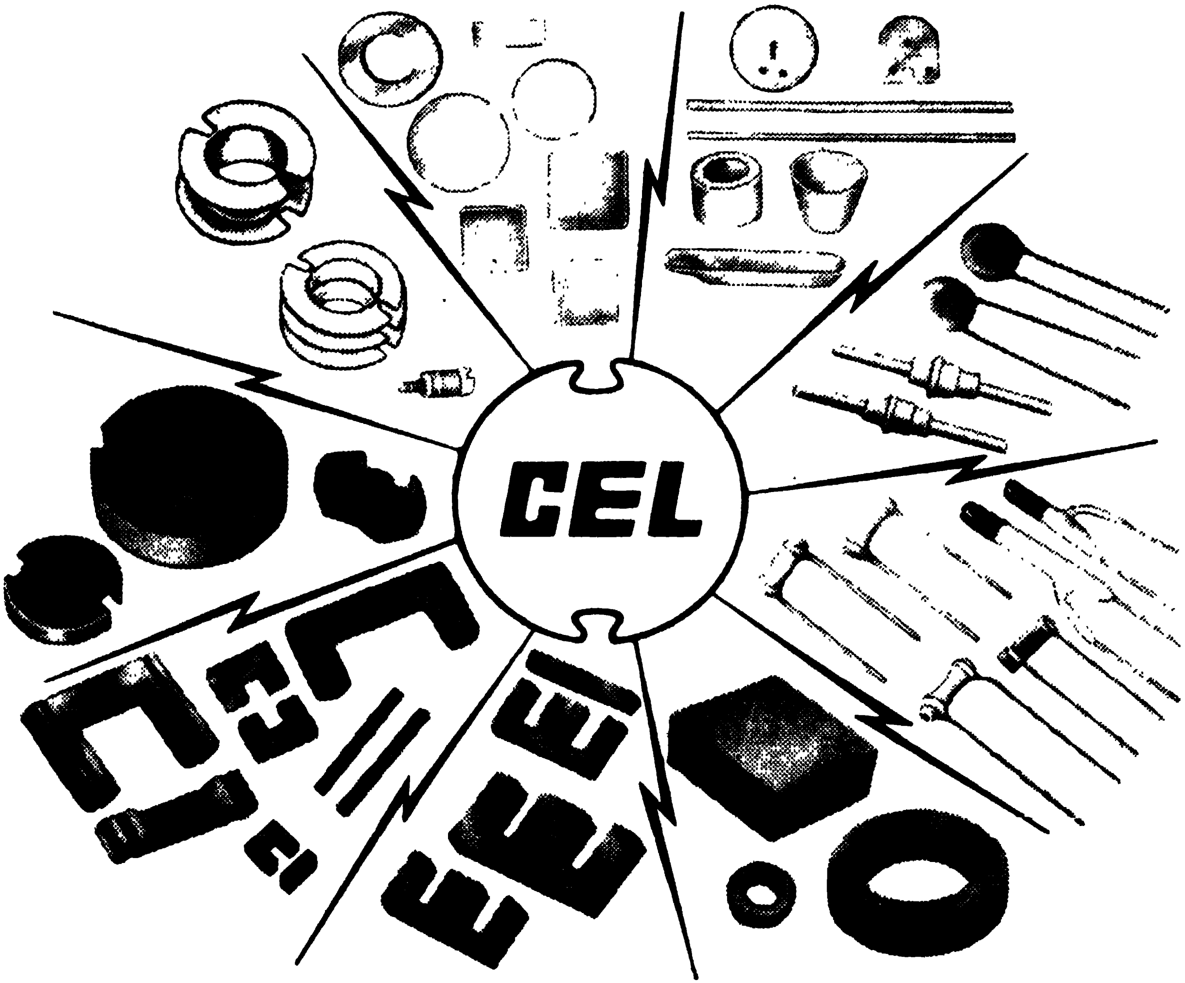

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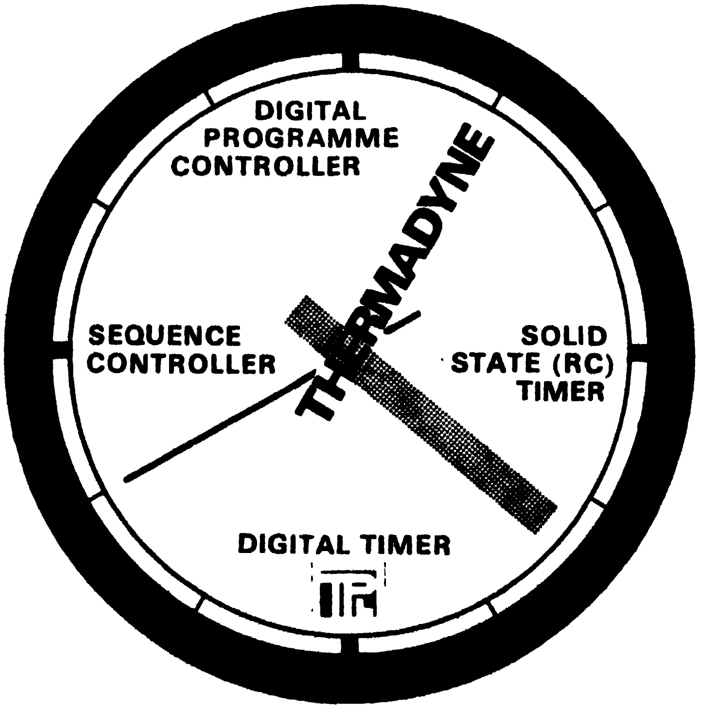

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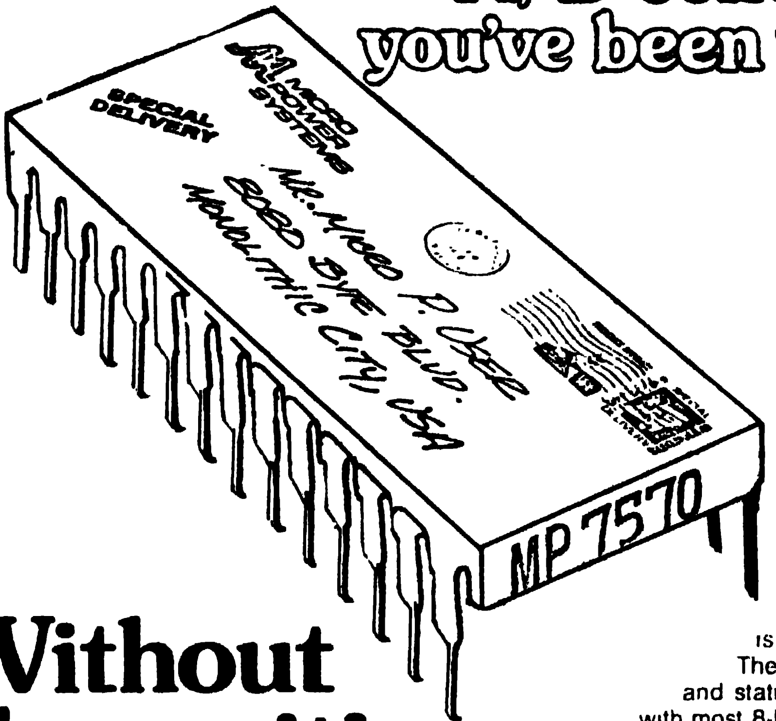

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Micro Power's proprietary High-Density CMOS is employed in producing the 7570. This low-power process features an on-chip network of thin-film resistors and silicon nitride passivation to enhance reliability and long-term stability.

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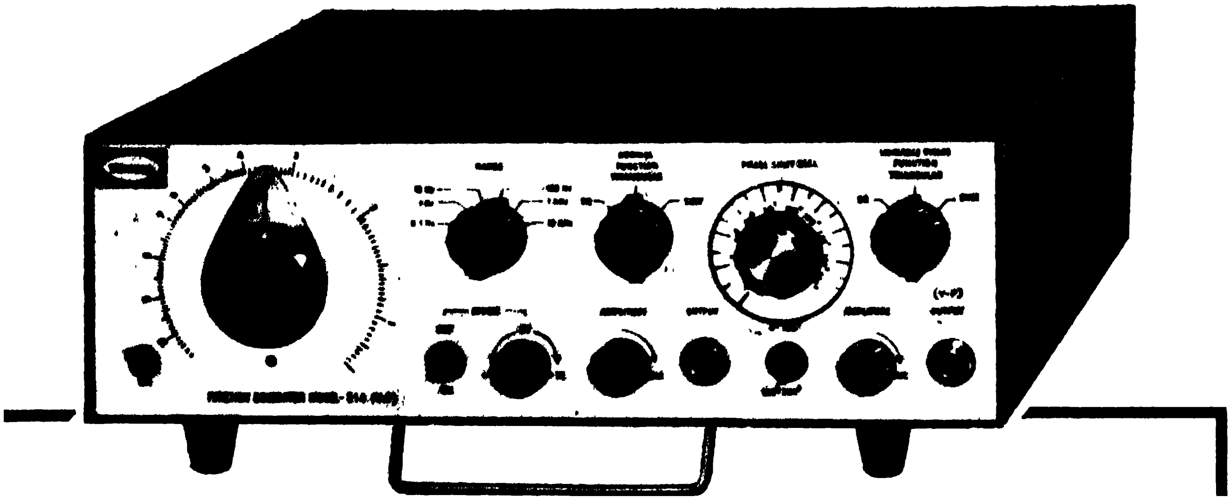

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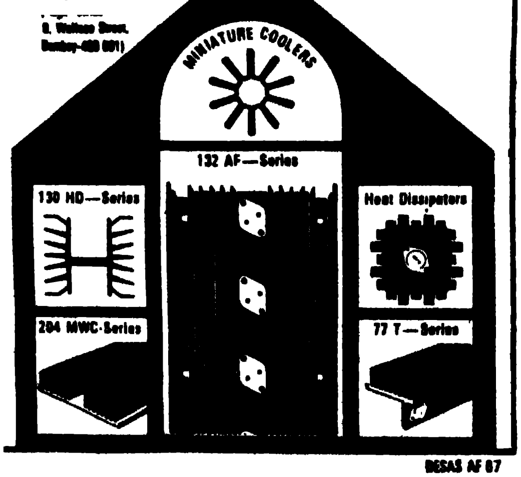

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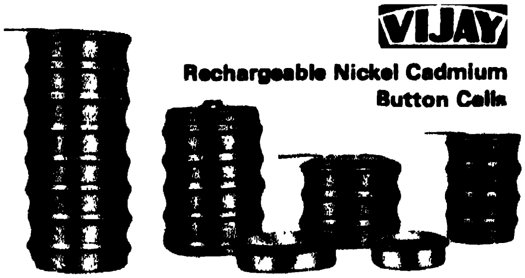

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EDITORIAL

ELECTRONIC WATCHES

The electronic watch is no longer a novelty. The simple 3.5-digit 5-function watch is now selling at less than US $ 10 each in the world markets. The futurists assert that the electronic watches are going to push out the mechanical ones. The Swiss suppliers of the mechanical watches are already feeling the pinch of the competition.

What about our country where the demand for watches—whatever type—remains unsatisfied despite the recent liberalisation of the import policy?

The electronic watch has already attracted the affluent classes in our country. One who travels to foreign lands comes back after each trip with an electronic watch adorning the wrist since it is no longer fashionable to bring in a radio or a TV or a cassette tape recorder, or even a pocket calculator. All these are being assembled in this country and their prices are relatively low and the quality of their performance is satisfactory.

There are four manufacturers of electronic watches in this country—Century, Monica, Raghav and Shreeshyla Timex (refer EFY Annual Number 1978, page 234). Century is located in SEEPZ and all its production is reserved for exports. The other three are also committed to exporting a part of their production. But all these three indigenous suppliers have not touched the tip of the iceberg.

The annual demand for watches—all watches—is estimated to be around six million. Once the domestic manufacturers come up to this level of production, the smuggling of watches would come to a stop—provided the prices are competitive. Because of the tight market conditions, if the manufacturers keep their prices high, no amount of appealing to patriotic feelings will stop smuggling of watches.

And this applies to electronic watches also. The manufacturers of electronic watches in this country can win over a fair share of the market if they keep their prices comparable to the international.

Among electronic watches, two types have become fashionable—LED and LCD, though the latter is clearly in the lead. Japan has emerged as a major exporter of LCD watches in the world. Both developed and developing countries are its clients. The Japanese watch companies are of the view that by 1980, one-third of the watches manufactured in the world will be of the LCD type.

At present, the battery in a LCD watch needs to be replaced after a year or two. Japanese companies are now working on LCD watches which will run for five years without replacement of the battery. (*Newsweek* for the week-ended January 30, 1978, has reported that K. Hattori & Co Ltd, Tokyo, Japan, has already succeeded in manufacturing an electronic watch which can run for about five years with an ordinary battery.)

In our country, price of the LCD watch is the Achilles' heel. Once it is brought in the range of Rs 200-300, it is likely to sweep the market.

Abroad, innovations on a wide scale are being attempted. Fountain pens and ball point pens have incorporated in them the electronic watches. Watches - cum - calculators are also being put in the market The LCD watchmakers in Japan and elsewhere are investing heavily in their development efforts so as to give unique features to their electronic watches.

Our manufacturers of electronic watches will have to keep an eye on developments in other countries so as to profit from their experiences. In the 80's the mechanical watch in this country will slowly give place to the electronic watch. It is indeed a challenging situation which demands acquisition of improved technology coupled with reduced prices.

If the import policy for the mechanical watches has been liberalised, why not apply the same policy to electronic watches which are expected to sweep our markets in the coming years?

The guidelines for the electronics industry for 1977-78 (October 1977 issue of EFY, page 48) state that "in view of the high import content, and time that would be required for indigenisation, low priority is accorded to electronic watches." It may be stated that the import content is high even in the case of mechanical watches, but the government has liberalised their import in CKD or SKD condition.

Why this indifference to electronic watches which have come to capture the imagination of the prospective buyers? Let the assembly of electronic watches be liberalised as the indigenous components—case, dial, strap—will be similar in the case of the mechanical and electronic watches.

It is suggested that the guidelines for 1978-79 should be suitably amended after a thorough re-examination of this question. ☐

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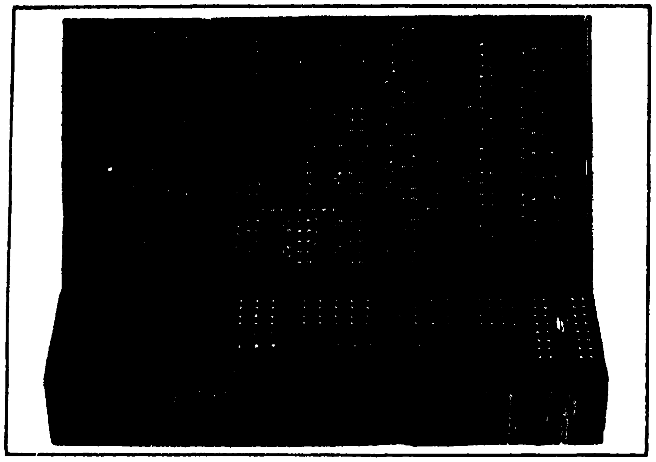
Model CT-11



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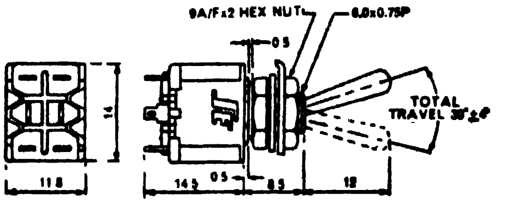

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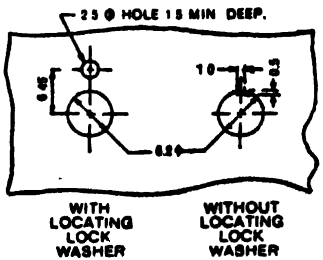

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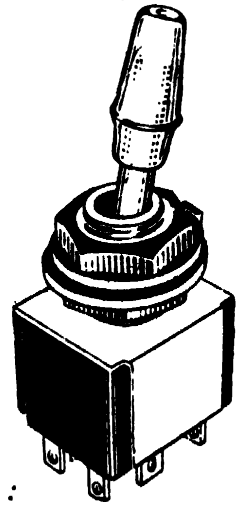

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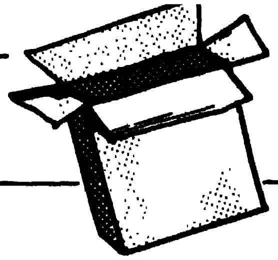

WHAT'S NEW

In India ...

Electronics in Haryana Expected to Grow

At present there are only eight units—all small - scale — in Haryana which are engaged in the manufacture of electronic products. These units are located in Faridabad and Ambala, and the value of their annual output is estimated to be around Rs 200 million.

The industries department in Haryana is planning to raise the production of electronic goods in the state to Rs 1000 million by 1983-84. Since the output of the electronics industry in the country is forecast to rise to Rs 18000 million, the share of Haryana would be between five and six per cent of the total.

In order to achieve this goal, two new growth centres for the establishment of electronic units have been selected, namely, Dundahera (district Gurgaon) and Ambala. An Electronics Testing and Developing Laboratory is being established at Dundahera. The exising facilities at Ambala for testing of electronic instruments and quality control are being strengthened. At the second stage of development, three new growth centres (at Hissar, Rohtak and Kurukshetra) would be set up.

Since the Dundahera complex is very near the Palam International Airport, the state government is urging the central goyernment to permit the establishment of an Electronic Export Processing Zone on the same pattern as the one set up at Santa Cruz, Bombay. The argument is advanced that in view of the facilities available in Delhi, this zone could be a flourshing centre for exporting electronic goods. Already the Directorate of Industries, Haryana, has selected 100 potentially viable electronic products whose production can be encouraged in this zone.

New Year Gift for Punjab Units

The Electronics Testing and Development Laboratory of the Department of Industries, Punjab, has started functioning for the benefit of electronics units in the state. Situated at D-11, S.A.S. Nagar (Mohali), near Chandigarh, the lab is expected to offer the following facilities:

1. Testing calibration and standardisation of electronic instruments with indigenous & imported equipment.
2. Product development in electronics.
3. Development of modern television circuits and antennae.
4. Modern tool room with machinery for making dies, jigs and fixtures.
5. Making of precision dies by spark erosion techniques.
6. Environmental testing of electronic equipment.
7. Sponsoring of applications for new electronic industries in Punjab.
8. Technical assistance to units in production.
9. Development of printed circuits.

New Products From CEERI, Pilani

The Central Electronics Engineering Research Institute (CEERI), Pilani, has developed a number of new products such as digital sound level meter, electret throat microphone, piezoelectric ceramic throat microphone, VHF multichannel varicap TV tuner, VHF television sweep generator and PF induction furnace.

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French Delegation Hopeful of Collaboration

A high level electronics and data processing delegation from the French ministry of industry had discussions last month with Prof. M.G.K. Menon, chairman of the Electronics Commission, and with other government officials, to work out a comprehensive cooperation agreement between France and India.

The delegation, headed by Mr Germinet — director in charge of international affairs in the Department of Electronics — ministry of industry — visited all major establishments in the field of electronics, data processing and computing techniques at Bombay, Hyderabad and Bangalore. Mr Germinet was of the view that there were good prospects of collaboration between India and French electronics companies.

And Abroad ...

New Minidiodes With 1mm Light Emission

The brightness of LEDs has been continually increased and now LEDs are on the market whose light emission is only one millimetre wide. The new minis are available from Siemens (W. Germany) in three colours (red, yellow and green) for use in wrist watches, cameras and many other small-size goods.

Previous LEDs, measuring from three to five millimetres, were too large for many applications, in particular because of their mounting depth. The new miniature design may be conveniently used for telling the photographer viewing an object whether the surrounding light is too bright, too dark or just right. Another suggestion is to illuminate the liquid crystal display of a wrist watch with the light emitted by minidiodes. This combination of LED and LCD will ensure readability also in the dark.

Measuring equipment of all types will benefit from this technological progress and this applies also to dashboard indicators for fuel gauges, temperature sensors and speedometers.

Quantity production of these new devices will soon be started by Siemens. The light intensity is about 1 mcd for 10mA. The plastic cover over the chips is transparent.

Holographic 3-D Film Made in USSR

Soviet cinematographers have made the first - ever three - dimensional colour motion picture, using the laser - based holographic method. Though the first experimental film of the kind lasted a mere 30 seconds, work is in progress at the laboratories of the Moscow Cine - Photo Research Institute for the production of holographic colour films of the duration of over 30 minutes and for a 300 - strong audience.

According to Prof. V. Komar, director of the institute, the scientists at the laboratory have successfully developed a method of recording 3-D colour images with laser beam. Though the camera originally developed for the purpose could take pictures of small objects only, a laser - based camera which can shoot large size scenes has already been designed, and work is in progress for making a holographic screen of complex structure.

INTELCOM 78 in September

Beirut (Lebanon) will host the first international telecommunications exposition in the Mideast (West Asia) this year. An exhibition will be held from September 11 to September 16, 1978 while the technical programme and training session will be extended over a period of 22 days from September 4 to September 25, 1978. The American University of Beirut will be the venue of the exposition whose theme will be 'Telecommunications Need of the Middle East, the Mediterranean Countries and Africa.'

At the same time, the Arab Telecommunication Union (ATU) will be holding its plenipotentiary meeting (held once in three years) at Beirut. For the next five years, the Arab countries will be investing more than 40,000 million in domestic development plans which will be largely financed out of oil income. A large fraction of this investment is bound to be on modernisation of telecommunications plants to bring them up to the level of the leading nations of the world.

Data Processing Machinery At Leipzig Fair

Exhibitors from 19 countries will be showing data processig equipment and office machinery at the 1978 Leipzig Spring Fair to be held for 12th to 19th March 1978.

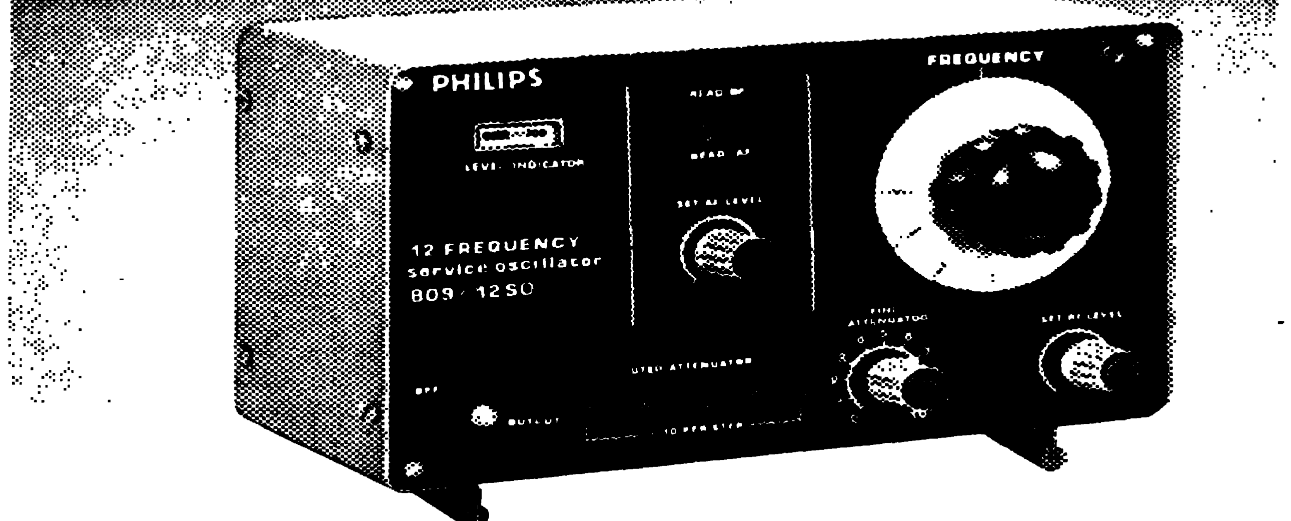
The GDR manufacturers will be represented by the foreign trade organisation, Robotron - Export - Import, and will include typewriters, accounting and invoicing machines, data acquisition devices and EDP equipment. Particular emphasis will be on the new EC 1055 EDP system. The multipurpose system has been designed for uses in science, business management and a variety of other applications.

Among the wide range of peripheral equipmental designed for use with the Robotron EC 2655 central unit and the EC 1055 system, will be the EC 7602 microfilm output device, different table and drum drawing units, high - capacity disk stores, and subscriber's stations for remote data processing. Also from the Robotron will be new and improved microcomputers.

Other items from GDR manufacturers will include the Daro 1720 automatic accounting and invoicing machine and the Daro 1750 magnetic account computer.

Presenting the unique high-accuracy, low radiation

12-Frequency Service Oscillator



from Philips

The new Philips 12-Frequency Service Oscillator is the first of its kind in India. It has been exclusively designed to obtain professional accuracy in your workshop at the price of an economical service oscillator. Capable of performing similar to any laboratory-class signal generator it guarantees:

Quick, easy operation
The definite calibration of this instrument enables easier and faster operation besides eliminating human errors during setting and reading.

High accuracy, minimum radiation
Since 12 frequently used spot frequencies are incorporated in this instrument, the output can be easily obtained with minimum errors. Comparative gain and sensitivity measurements in broadcast receivers are possible with this instrument.

Economy
It can give a performance similar to a professional signal generator, yet it is priced just as much as conventional service instruments.

Ideal for:
a) Comparative receiver measurements such as stage gains.
b) Alignment of RF & IF stages.
c) Fault-finding by signal analysis method.

Technical Data

Frequencies:	KHz		MHz	
	452	1.5	5	11.8
	455	3.15	7.2	15
	560	4	9.6	21.5

Output (RF):
35 mV RMS max. modulated at 30% with 400 Hz (on every frequency); can be attenuated in steps of 10 and continuously.

Modulation Frequency:
400 Hz

Supply Voltage:
240V 50 Hz AC.

Dimensions:
Length 223 mm.
Breadth 115 mm.
Height 150 mm.
Weight
2.2 kg. (Approx.)

Service
Service
Service

Price
Rs. 840/-.

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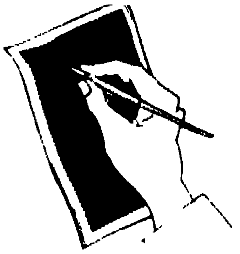


LETTERS

LICENCE FOR REMOTE CONTROL

Having read my article on 'Radio Remote Control of Models' published in the May '77 and June '77 issues of your magazine, some persons required clarifications regarding licensing procedure for the 27.1MHz Citizens' Band.

The equivalent of CB licence is known as the 'Experimental Wireless Station Licence' (under radiating conditions) in India. An applicant has to fill in a set of forms in duplicate and submit these to the Government of India, Ministry of Communications (W.P.C. Wing), Sardar Patel Bhavan, Parliament Street, New Delhi 110001.

Up to a maximum of 400 milliwatts of input power with an antenna not longer than two metres is generally permitted. If the master oscillator is not crystal controlled, a frequency measuring instrument must be used. But it is wiser to use a small crystal which is made to order by Bharat Electronics and costs around Rs 70.

Self construction of equipment is permitted. Circuit diagrams and details regarding construction have to be furnished in addition to the forms. The forms are available from the ministry

If the licence is granted, the ministry will inform the applicant and require a fee to be paid. The licence remains valid upto 31st December of that year.

K.G.DEB.
Bamra (SE Rly)

MORE PROJECTS

Seeing that you publish some articles on the construction of electronic gadgets in every issue, it surprises me that you do not give the average price of the components used.Giving the price will be, I am sure, most helpful to the constructors and hobbyists.

Further, I think your magazine would become even more popular with its readers if you were to publish more electronic projects for hobbyists.

RAJEEV ROHATGI
Calcutta

IN APPRECIATION

Your magazine has improved to a great extent. I hope it will come up to the standard of Popular Electronics (published in the USA) in the near future.

As an encouragement, I have decided to help in increasing the number ot your subscribers to the extent possible for me. If each subscriber introduces even one more new subscriber, I am sure the standard of your magazine would improve still further.

K.KARUNAKAR
Ongole

☐ Please accept my grateful thanks for your Annual Number 1978 received by me just now. It is really beautiful.

R.L.JAIN
Teen Murti Electronics
New Delhi

☐ This is to thank you for the Annual Number 1978 which I have just received. The issue is most informative.

B.P. PEREIRA
Madurai

CITIZENS' BAND TRANSMISSION

In ELECTRONICS FOR YOU for the month of May 1977, an article entitled 'Radio Remote Control of Models' by Mr Keshari Gang Deb was published wherein it was stated that "there is a special band known as the Citizens' Band (27.1 MHz) for which no tests are required. One may straightaway start off with radio telephony. . . . ."

This raised a query from a number of our readers who wanted to know if it was true that no licence was necessary for the Citizens' band transmission, especially for low-power transmissions used in radio control.

We addressed a communication to The Engineer, Ministry of Communications (WPCWing), Sardar Patel Bhavan, Parliament Street,New Delhi. In reply, we got a cyclostyled reply which stated that a licence was necessary to establish, maintain and work a wireless telegraph/ telephone station in India. Obviously, the government of India treats the Citizens' band transmission on par with any other transmission! But the letter from Mr Deb printed along side is self-explanating.

Complete Sets of EFY's 1977 issues

A limited number of complete sets of the ELECTRONICS FOR YOU issues published during the year 1977, including Annual Number 1978, are available at their face value. Those who desire to have these issues may kindly get in touch with us at the earliest as the stocks are likely to exhaust very soon.

—Circulation Manager

PLEASE NOTE

Annual Number 1978 includes the December 1977 issue . There was no separate issue for this month, as ever.

Beginning of Broadcasting in India

G.V. Sulu VU2GV

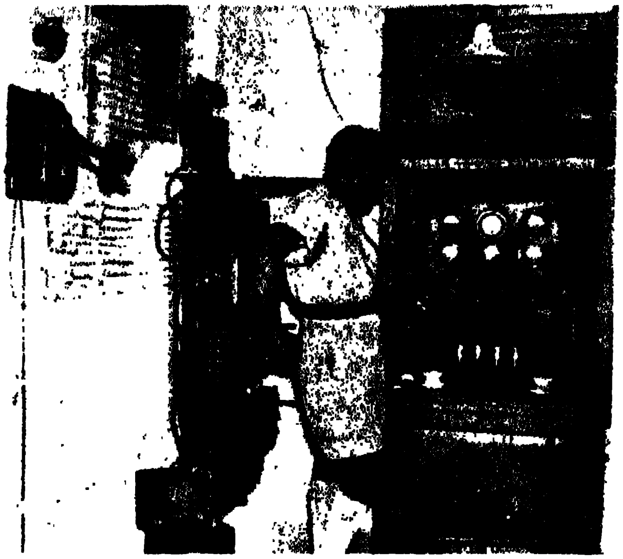
A leading historian once said that we, as a nation, lack the sense of history. In keeping with this 'tradition' when the All India Radio (AIR) authorities decided to celebrate the golden jubilee function in July and August 1977, they never bothered to research about the early history of broadcasting in India. This fact was borne out by the speech of the director general of All India Radio on July 23, 1977 at Bombay. In the Golden Jubilee function, while welcoming the prime minister, Mr Morarji Desai, the director general appealed for funds to write the history of broadcasting in India.

It is not known as to what prompted AIR to go in for golden jubilee celebrations in 1977. Perhaps under the relaxed atmosphere created by the new government AIR wanted some occasion to celebrate, and selected the first fifty years of the inauguration of the Bombay and Calcutta radio stations of the Indian Broadcasting Company for this purpose. It was called 'Fifty Years of Broadcasting in India' and as an after-thought, it was qualified as 'Fifty Years of Organised Broadcasting.'

The AIR brushed aside all the early broadcasting as, in its view, it was all experimental. The fact that the so-called organised broadcasting – a commercial venture of a private company – was also an experiment which failed within 33 months of its inauguration, was conveniently overlooked.

In all the special features put out over the radio and TV and the articles published on this occasion in various magazines and newspapers, there was a mix-up of fifty years of broadcasting in India, and fifty years of Bombay station. And some VIPs even called it 'Fifty Years of AIR'! In none of these writings or broadcasts, however, any mention was made of the early broadcasting stations set up at Madras, Calcutta, and Bombay in 1924.

It is on the records that broadcasting in India was started by the Madras Presidency Radio Club, and Mr C.V. Krishnaswamy Chetty was the pioneer of this venture. While he was a student of the Madras Christian College, Mr Chetty read about the experiments carried out abroad by Hertz, Righi, Branley, and Marconi. During the vacations he used to spend hours and hours in assembling battery cells and wireless receiving sets with 'Coherer'. Later he went to the United Kingdom for higher studies and obtained a B.Sc. (Tech) degree in 1910. He was elected Associate Member of the Institution of Electrical Engineers (I.E.E.) On his return, he joined the Madras Electric Supply Corporation. In 1914 he was appointed as an electrical engineer by the Madras City Corporation. At that time he was a full member of the I.E.E. and the secretary of its Madras branch.

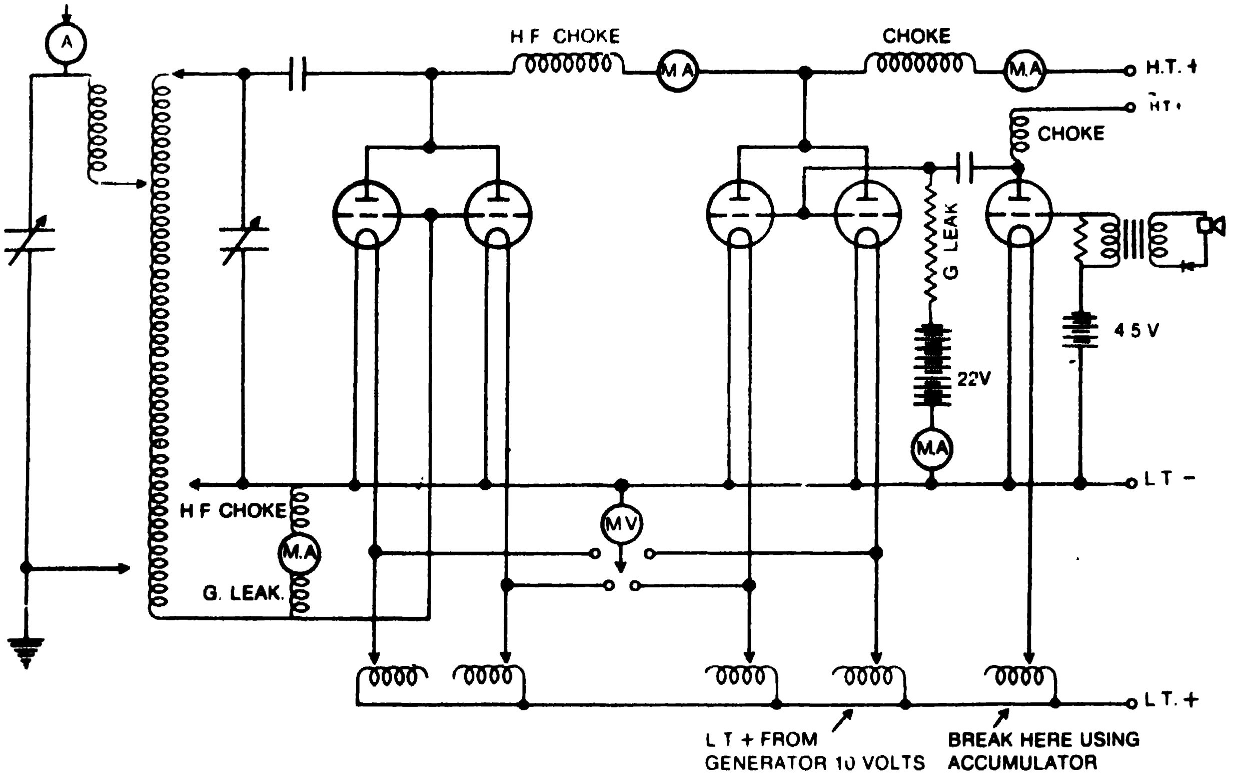


Madras Presidency Club's radio transmitting set which was presented to the Madras city corporation and was in use till 1938

While in the UK, he observed the emergence of wireless communication at close quarters. On returning to his homeland, he rigged up a better wireless receiver which picked up radio stations from the UK and the Hague. Since broadcasting was pioneered by the radio amateurs in most of the western countries, he was very much interested in assembling a transmitter for broadcasting in India. But the non-availability of the vital components for the assembly of the transmitter was a major hurdle. It is believed that he even attempted to fabricate triode valves for his transmitter with the assistance of goldsmiths and glass-blowers, though with no luck.

In the beginning of 1924, a representative of the Marconi Company brought a 50 watts transmitter and demonstrated it in all the major cities in our country. His demonstration in Madras triggered the enthusiasm of the amateurs there. Taking advantage of the favourable climate, Mr Chetty founded the Madras Presidency Radio Club with H.E. Viscount Goschen, the Governor of Madras, as the patron. It appears that the club got some hard-to-get components for its transmitter from the representative of the Marconi Company. So much so, within two months of the formation of the club the members assembled a 50-watt transmitter and started broadcasting from July 31, 1924.

Later, this club obtained a 200-watt transmitter from



Circuit diagram of the 200-watt radio transmitter which was first used in India in 1924 by the Madras Presidency Radio Club. In October 1927 this club was wound up and the transmitter was presented to the corporation of Madras who started a regular broadcasting service from April 1, 1930. This transmitter had to be put out of commission from June 16, 1938 — the day Madras station of the All India Radio Station was established. Subsequently, it was presented to the government museum in Madras by the corporation.

Marconi Company which, it seems, was a present. This transmitter had two oscillator and two modulator valves with a preamplifier for the microphone. These valves required 24 volts DC for filaments and 1,500 volts for the plates. To supply these two voltages a double commutator generator coupled to an electric motor was used. The transmitter was tuned to 411 metres band and was coupled to a six-wire cage aerial which was 12.2 metres high with a counter-poise of four wires 7.6 metres below the aerial and 2.4 metres above the ground level.

The programmes were transmitted daily between 6 pm and 8 pm. In the evenings whichever artist dropped in at the club, just for the fun of singing on the radio, was handed over the microphone. The improvised studio of the station had a piano, tabla, mridungam, a leg-harmonium, and a gramaphone with pick-up. If no artist turned up, the gramaphone records were played. Mr Victor Paranjoti and Binstead used to present western music and programmes in English. The names of some leading Carnatic musicians are also found in the list of those who frequently gave concerts.

The club's transmitter was under the charge of Mr T. Kodandaramiah. Apart from maintaining and operating the transmitter, he was also doing the announcements and disc-jockeying—purely a voluntary service. Mr Kodandaramiah was the first broadcast engineer, radio announcer, and disc-jockey of India.

When this station began broadcasting, there were only about thirty enthusiasts who could receive the programmes in their crystal sets. In those days assembling a crystal receiver was a technical feat. And getting a licence for it from the British government was a tough job. But, within a year, the number of licences rose to a hundred. Some of them used a single-stage audio amplifier with a 'diaphragm speaker' that could be heard in a room. The Madras club was getting a share of the radio licence fee collected by the Posts and Telegraphs department. However, the expenses in running this club station were largely met out of the contributions and donations received from its members. Eventually, mounting running expenditure and lack of sustained financial support from the members forced this club to wind up broadcasting in October 1927—nearly fifty years ago.

Very shortly after the beginning of the Madras Club Station broadcasting with call sign '2GR', the Radio Club of Bengal started its broadcasting with call sign '2BZ'. It was followed by the Bombay Presidency Radio Club—call sign '2FV'. Bombay's 100-watt station was heard in far off places such as Ranchi and Rawalpindi. Its broadcast were in 387 metres band.

The Radio Club of Bengal was publishing a monthly entitled 'Radio' since January 1925, edited by Mr G. Briggs, with the editorial and publishing offices at East India Radio Co. (Grosvenor House, Calcutta). The 'Radio' was priced Re 1 per issue and was well patronised by the advertisers. It was the first radio magazine of India.

Mr C.V.K. Krishnaswamy Chetty, the pioneer of radio broadcasting in India.

'Radio' issue of January 1926 is available with this writer; it contains articles, both technical and general, and programme schedule of the Calcutta, Bombay, Rangoon, and Colombo stations. It also has a listing of the foreign broadcast stations heard in India. At the end it has a single page 'call book' containing call signs and addresses of the 42 amateur stations in India which were active in 1925. As per the information in this issue, by the end of 1925 Calcutta and three amateur stations were broadcasting regularly on the medium waves with 100 watts power each. They put out concert music, news, time signals, weather reports, etc.

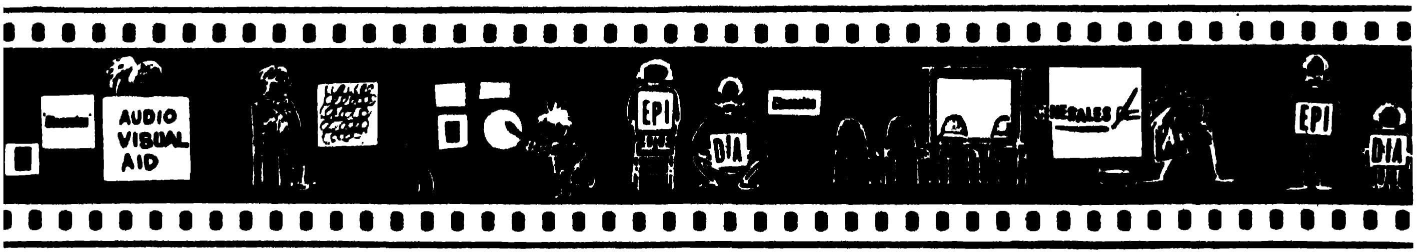
In 1926 the Indian Radio Telegraph Company, which undertook the building of beam stations for Imperial Wireless Chain, received the permission from the government of India to form a separate company for the purpose of broadcasting in India. As a result, the Indian Broadcasting Company with a capital of Rs 1.5 million was formed to set up two high-powered radio stations at Bombay and at Calcutta. This company was to get 80 per cent of the radio licence fees collected by the Posts and Telegraphs department with the remaining 20 per cent going to the government.

The Bombay station of this company was inaugurated on July 23, and the Calcutta station on August 26 of 1927. Consequent on the commencement of broadcasting by this company, amateurs and amateur clubs were prohibited from broadcasting and were asked to confine to their point-to-point communication only. And the power of the amateur transmitter was also restricted to 10 watts. This put off the Bombay and Calcutta amateur broadcasting stations. Since there was no radio station of the company in Madras, the Madras club radio station was allowed to continue. But due to financial difficulties this station was wound up later, after forty months of fruitful operation.

Transmitter of the Madras club was presented to the Madras city corporation by Mr C.V.K. Chetty; he successfully persuaded it to take up broadcasting as an amenity to the public. As a result, the corporation's broadcasting was inaugurated on April 1, 1930 by Dr A. Ramaswamy Mudaliar. This station had an improvised studio in the annexe and the transmitter on the terrace of the Rippon Building. Since Messrs C.V.K. Chetty and T. Kodandaramiah were both working in that corporation, naturally they were also looking after the transmitter and the entire administration of the station till 1938 when opening of the Madras station of AIR forced the closure of the corporation's broadcasting.

Thus, between 1924 and 1938 Mr C.V.K. Chetty pioneered broadcasting in India. Throughout he was ably assisted by Mr T. Kodandaramiah. When the history of broadcasting in India is written, the names of these two pioneers should be written in letters of gold, and Mr C.V.K. Chetty given the due credit and declared as The Father of Broadcasting in India. ☐

Mr T. Kodandaramiah, the first broadcast engineer, radio announcer and disc-jockey of India.



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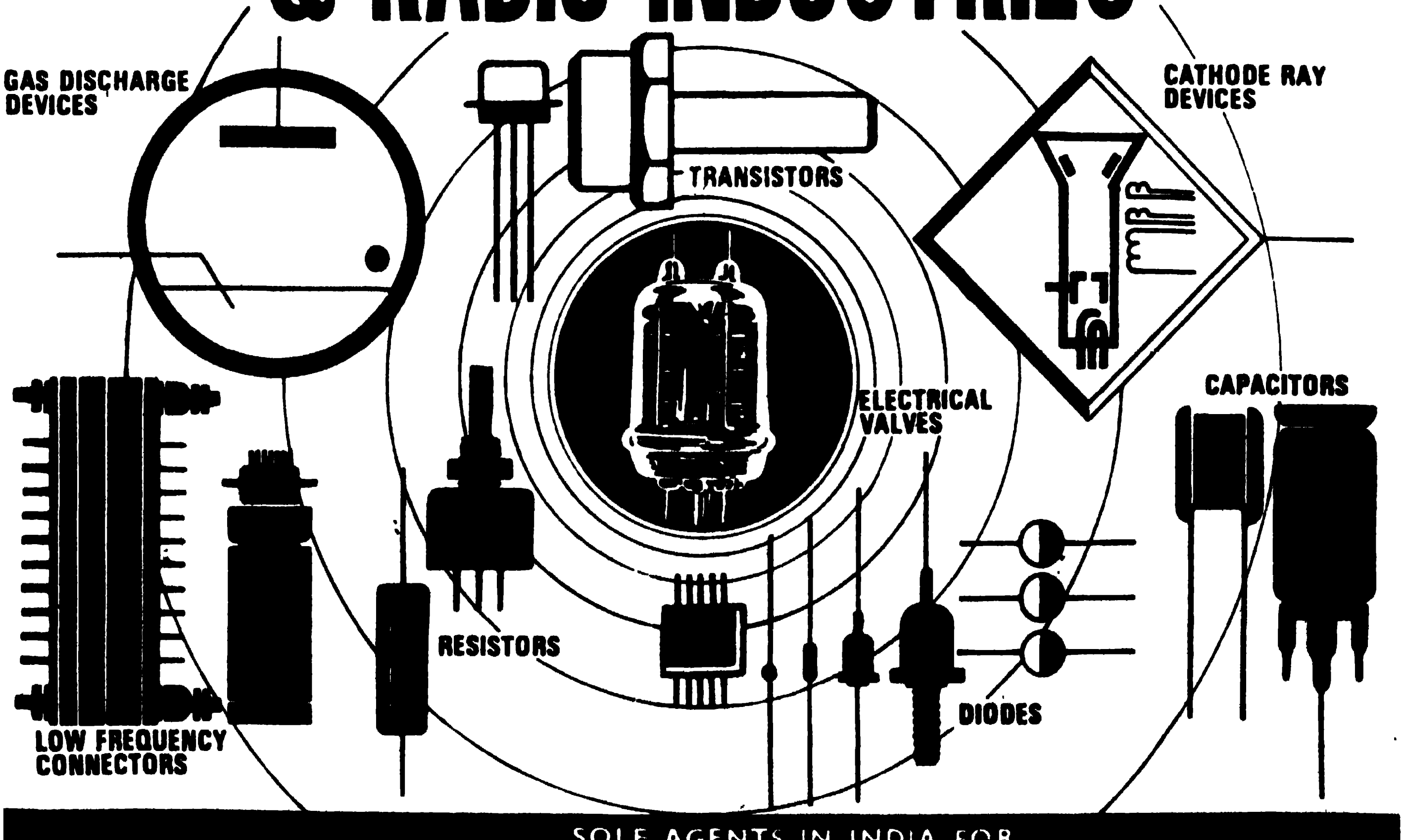

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MINICOMPUTER PERIPHERALS

J.T George

By the turn of this decade the turnover of computer and associated equipment manufacturers is expected to be greater than that of any other organised industry in the United States. The computer industry can be classified into three categories, namely, a small number of giants making big computers and compatible peripherals, a large number of manufacturers of minicomputers, and a still larger number of a wide variety of minicomputer peripheral equipment suppliers. The predicted growth of minicomputer industry is around 30 per cent per annum for the next five years.

Earlier the computers were exclusively used in the domain of scientific, technical and large-scale commercial applications. However, during the past few years the minicomputer manufacturers have given a new architectural get-up to the computers, diversified their end use, and above all made them within the reach of original equipment manufacturers by slashing their cost. The vast reduction in the cost of integrated circuits and large-scale integration have made this possible.

Minicomputer definition

What is a minicomputer? Any attempt to define a minicomputer will evade an answer and it is unlikely to be generally acceptable. The definition of minicomputer has been changing with the passage of time and is dependent upon the state of the art of hardware and overall system cost.

However, it is possible to classify the minicomputers according to their cost, mass production, ease of maintainability by the user and the amenability to programming by non-experts.

Viewing from the hardware point, these machines have a word length of 16 to 32 bits, memory in the range of 8 k to 256 k bytes or more; ease of interfacing to a wide variety of peripherals, if need be at the users' premises, physical size and ability to survive in uncontrolled environmental conditions are other attributes of the minicomputers.

Peripherals

The minicomputer peripheral market is wide and varied. In large computers the processor cost is much more than that of individual peripherals; in minicomputer-based systems the computer may be used as an extension of the peripheral and may represent only 20 to 30 per cent of the total system cost. The peripheral devices which communicate signals between the computer and the controlled enviornment and which enable the minicomputer data storage expansion are a significant part of the minicomputer market.

Earlier the peripheral manufacturers were mainframe makers who together with their associates held the market; but now with the proliferation of minicomputers the list of independent peripheral suppliers has grown longer and bigger.

Miniperipherals are relatively small in size and can be placed on table top or rack mounted together with the minicomputer, though there are a few exceptions. They are much less expensive than their medium and large-scale computer counterparts, although they have technically many things in common.

It is, however, possible to connect any standard large-size computer peripheral to a minicomputer if cost is not taken as the prime consideration.

Miniperipherals, in comparison with standard peripherals, are generally at the low end of the performance scale. Their cost may vary from a few thousands of rupees to a few tens of thousands.

The common miniperipherals are teletypewriters, CRT terminals, magnetic tape cassettes, magnetic tape drives, floppy disks, disk cartridges, printers, plotters, A/D and D/A converters, relays, programmable clocks, modems etc. The salient features, specifications and cost ranges of some of them are discussed below:

Teleprinter

Teleprinter is one of the most popular peripherals used with minicomputers. Almost every computer is equipped with one teleprinter-like device for print-out. An interactive teleprinter includes an alphanumeric keyboard, a hard copy printing unit and, at times, a paper tape read-punch device. Teleprinters can transmit as well as receive digital information from a nearby or remote computer.

Teleprinters are classified operationwise into three categories, namely: Receive Only (RO), Keyboard Send Receive (KSR) and Automatic Send Receive (ASR).

Of the two basic printing techniques used in teleprinters, the impact printing is at present the most widely used, but is being phased out by the non-impact type. Ordinary paper rolls can be used in impact type and this type is ideally suited for providing multiple copies. However, they tend to be noisier and breakdowns are frequent.

Many variations in character font mounting such as typebar, drum, wheel, spherical print-ball and chain are common. The latest trend is to use dot matrix printers.

In the US about 40 manufacturers are in the teleprinter line. The cost ranges from Rs 10,000 to Rs 40,000, according to type, print method, number of columns, print speed, character codes and transmission speed.

Mr J.T. George is head of the computer section in Vikram Sarabhai Space Centre, Trivandrum.

CRT display

CRT displays are the most convenient man-machine interactive devices connected to minicomputers. The main limitation is that they are unable to produce hard copies, unless interfaced to a hard copy unit. However, they offer extensive editing and block transfer of edited message to minicomputer.

The CRT display terminal typically consists of CRT display unit, keyboard, refresh storage and control, character generation and communication interface. These devices can be divided into two categories— those that are purely alphanumeric and those that have graphic capability. CRT displays may be designed to have a high refresh rate or they may use storage techniques to achieve a steady display.

The features of the display include the size of the display area, the number of characters per line, lines per display and the methods used for character generation.

CRT displays are currently available with useful writing surfaces of up to 23 cm x 30.5 cm. Some terminals offer a paging capability where a buffer is organised to hold more data than can be displayed on the screen at any one time. The stored data can be displayed on command, a 'page' at a time, or rolled back and forth in front of the display window or viewing area.

Another feature of the CRT is the cursor. A cursor marks the position on the screen where the next character will be read or written from memory. The cursor can be moved right or left and up or down.

CRT terminals can be operated in the teletype mode where each character, when entered on to the screen, is simultaneously transmitted to the minicomputer, or in a block mode, where the entire message can be composed and edited off line on the screen before it is transmitted in full to the computer.

The check list for CRT selection includes terminal features like option for cassette, display characters, edit features, speed of communication and software support.

The teleprinter, earlier described, once the mainstay of world's computer input/output peripherals, is falling out in favour of CRT displays.

Dot matrix printers

Advances in solidstate electronics, together with innovative printing mechanisms, have enabled manufacturers to produce faster, more versatile and operator efficient printers.

Unlike line printers using fixed arrangements of characters formed on a ball, drum or chain the dot matrix system makes character shapes from a series of dots which, depending on print clarity and the font required, consists of an array of 5 x 7, 7 x 7, or 9 x 7 dots.

A great advantage of this printing technique is that character sets can be easily changed electronically and could be even under software control. Special characters or symbols present no problem, provided the pattern can be formed by the matrix dots. Since the printing process lends itself to electronic control, it has become viable to include a microprocessor controller in the printer which offers many advantages.

A vertical row of about seven printwires forms the basis of the print head mechanism. When printing impulses are received, the solenoids are selectively energised to drive the wires against the inked ribbon, paper form and platen to form the first vertical row of dots in the construction of a character. Four to five carbon copies can be had at a time. Paper movements and character shifts are accomplished by solenoid action or stepper motor and linkage assembly. The dot matrix printers give the user a variety of options and cost around Rs 50,000, including control.

Centronics were the first to introduce dot-matrix printer, and now most of the major minicomputer manufacturers have announced alternative microprocessor controlled dot-matrix printers.

Digital Equipment Corporation (DEC), with their experience in high volume manufacturing, have now cleared up much of the business with their versatile low-cost dot-matrix printer key board terminal.

Cassettes

Philips were the first to introduce cassettes in the market. Cassette drives adopt either continuous or incremental recording. Both the types of recording are performed bit serially on one or two tracks. The so-called continuous recorders write serially on to the tape in groups of bits (typically 8 or 16). The groups of bits are organised into words which, in turn, are structured into records. A record may range from two to several thousand words. Again, the records are grouped into files, which range from two to hundreds of records.

Words are recorded in a synchronous manner and records are separated by inter-record gaps. Cassette recorders can record one million characters per tape or more.

Incremental cassette tape drives record data by starting and stopping the tape for each bit or character, thereby eliminating the need for inter-record gaps. This mode is ideal for asynchronous operation with a teleprinter or CRT terminal by avoiding the requirement for buffering.

Very few cassette recorders have identical performance and characteristics; most manufacturers prefer to design what they consider to be the best fit for the user market.

Important cassette tape characteristics are defined by cassette capacity, type of drive employed, record file and tape lengths, recording technique, number of tracks, recording density, error detection capability, transfer rates, rewind time, bidirectional read/write capability, software support and available interfaces.

Floppy disk

Floppy disk was born at IBM research lab, under the direction of Alan Shugart. That was in 1967, and eventually in 1970 IBM at last introduced a floppy disk which was used as a read only device for loading programmes to detect faults on IBM 370 machines and thus reduce maintenance time.

The floppy disk is a combination of magnetic tape and disk technologies. The recording medium called a diskette (a name invented by Innovex) is oxide coated mylar just like magnetic tape. The disk is housed in a plastic cartridge which resembles the jacket of an LP record.

The plastic case that houses the diskette has three holes, one for spinning, one for read/write head, and the last for index mark access. The case remains stationary while the disk rotates inside it. Unlike other disks, a floppy read/write head actually comes in contact with the recording medium. The physical contact causes wear, so a floppy disk inevitably has a shorter life. The read write head is moved from track to track by a lead screw driven by an incremental stepper motor. The access is, therefore, relatively very slow.

IBM floppy is divided into 77 tracks and rotates at 360 rpm; information contained in about 3000 cards can be stored on one disk. To increase storage capacity IBM later used both sides of the disk by incorporating a dual read write head on the drive. The new Shugart 850 and Data Recording 1200 have the above option providing a storage of up to 12.8 M bits (1.6 M bytes) of unformatted data.

Floppy disks will find application on smaller remote batch and intelligent terminals where cost is crucial. Floppies comprise ideal bulk memories for intelligent terminals, because they operate at speeds compatible with human operators, offer rapid data transfer to another device, provide true random data access and once accessed show high reliability compared to cassette tape.

The introduction of Shugart's minifloppy has crashed the price to about $ 400. The hobby market for minifloppies is booming in the US. The floppy is yet another nail in the punched card, paper tape coffins! The market for floppies is well established and Shugart, CDC, IBM etc, have already had considerable success in floppy business.

Analogue to digital (A/D) and digital to analogue (D/A) converters

A large number of minicomputers are used in data acquisition and process control equipments and their usage is on the increase. They are generally used to perform acquiring, monitoring and controlling parameters such as pressure, temperature, displacement, liquid flow and a host of others in industrial and laboratory environments. Many minicomputers manufacturers nowadays offer A/D and D/A converters as a standard peripheral.

When data are to be logged from more than one sources, multiplexed A/D converters are employed. The output of the analogue channel should normally be in the -5V to $+5$V range. The resolution varies from 8 to 14 bits. The conversion time lies in the 2 to 50 microseconds range for about 10 bits output. The cost of A/D converter increases rapidly with accuracy above 12 bits.

Some systems can handle data up to 1024 channels by multiplexing. The multiplexing can be performed sequentially or randomly under programme control. A/D systems invariably include a real time clock for programming.

Conclusion

There are many other peripherals such as plotter, line printer, card read-punch, tape read-punch, etc, which form part of the minicomputer configuration. Since they are very much in use with mainframe computers they are not reviewed in detail. As mentioned earlier, any peripheral can be interfaced to a minicomputer if cost is not the consideration.

The rapid decrease in cost and increase in power and reliability of minicomputers have widely extended the market needed for peripheral equipments. In foreign countries many minicomputer manufacturers have developed to varying degrees, range of peripheral equipments, communication interfaces and compatible software. Despite this, the list of independent peripheral suppliers continues to grow with costs of peripherals coming down. Unfortunately, in India, only a feeble attempt has been made to manufacture peripherals, so far.

Peripherals provide building blocks, and it is for the user to put them to effective use and get the best out of them. □

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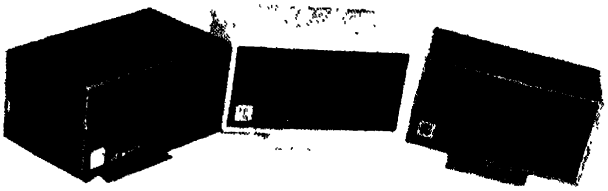

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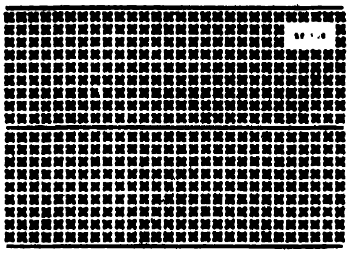

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High-Low Voltage Cutout With Delay to Protect Mains Operated Gadgets

D. Venkatasubbiah

A simple cutout that can protect your costly gadgets from either high or low AC mains voltages is described here. It switches off AC supply to a gadget if the voltage goes beyond the normal operating limits.

The cutout also operates with a delay feature which provides protection against transients and unnecessary momentary switching on during power failure periods. Due to operating delay, as the power is switched on, the gadget is not powered immediately. The cutout waits and watches for about half a minute, and if the power is stable and there are no power trips, only then power is applied to the gadget under its protection.

Two special features of this cutout are: (i) it uses a single relay and a single integrated circuit, (ii) no transformer is used either for deriving DC voltage supply or for providing monitoring voltage. The whole circuit can be built into a plastic lunch box.

How it works

The 12V DC is derived by using the transformerless power supply arrangement described in the November 1976 issue. [Ed: Please see the author's article on page 33 of that issue.] It consists of R1, C1, D1, Z1 and C2 in the circuit diagram (Fig.1). The monitor voltage is obtained by the potential divider comprising R3, C3 and R2.

Zener diode Z2 shorts the negative voltages and limits the positive peaks to 11V. Thus, its purpose is only transient protection rather than controlling the output voltage. D2 allows the current to flow only into the load and not in the reverse direction. The current flowing though R2 is directly proportional to AC mains input. Thus, the voltage drop across it is a measure of AC supply variations. C5 is the smoothing capacitor. R4 and C4 form the delay circuit.

The IC dual operational amplifier is used as a window detector with two comparators, one for 'high' and the other for 'low' limits. A noval feature is that it is connected in a simple way and uses a single DC voltage. Diodes D3 and D4, together with resistor R5, form an AND logic circuit.

When the AC supply is within limits, both comparators give high output and the AND circuit also gives a high output (about 11V) which is used to actuate the relay. Outside the limits, one of the comparators gives high output and the other gives low output (about 3V). The AND circuit gives low output which unoperates the relay. Diode D5 shorts the reverse voltage surges caused by the current switching in the inductive relay and protects the transistor.

How to adjust

Adjust potentiometer P1 for the lower limit, which can set the reference at the variable point of potentiometer from 0 to 6V. Adjust P2 for the high limit, which can set the reference at the variable point of potentiometer from 6 to 12V. Nominal operating limits are between 180 and 250V. If the monitor voltage is 7V, with nominal 220V AC supply, set P1 to give about 5V and set P2 to give about 8V.

Precise settings can be made by varying the input AC supply using a variac. With 180V AC, adjust P1 to just unoperate the relay. Then with 250V AC adjust P2 to just unoperate the relay.

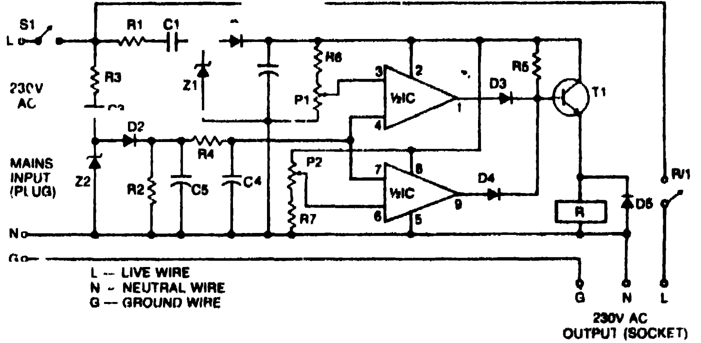

Fig. 1: Circuit diagram for the high-low voltage cutout

PARTS LIST

IC1—747 integrated circuit (SEM)
T1—CIL 521 npn transistor (CDIL)
D1, D2—DR50 diode (BEL)
D3, D4, D5—OA85 diode (BEL)
Z1—3Z12 zener diode (ECIL)—3W, 12V rating
Z2—FZ 11 zener diode (ECIL)—400mW, 11V rating
C1—1uF, 400V bipolar capacitor
C2, C5—250 µF, 12V electrolytic capacitor
C3—0.3 µF, 400V bipolar capacitor
C4—2000 µF, 12V electrolytic capacitor
R1, R3—100 ohm, 2W resistor
R2—680 ohm, 1W resistor +1%
R4—5.1 kilohm, 1/4W resistor
R5—10 kilohm, 1/4W resistor
R6, R7—4.7 kilohm, 1/4 W resistor, ±1%
P1, P2—4.7 kilohm wirewound potentiometers
S1—SPDT on/off switch
R —9V, 10mA relay with two changeover contacts, 3A contact rating

Applications

This device can be used with all expensive gadgets which need protection against either high or low voltages, or both. For example, the most common but costly gadgets like a television set or a refrigerator can be protected with it.

Higher voltages than specified are harmful to all gadgets because they drive higher than rated currents through the gadgets. Even a 220V incadescent lamp will fuse if we operate it beyond a limit, say 250V.

In case of motors, even low voltages are harmful. When the voltage is low the motor may not start to rotate, and due to the absence of back emf, high currents will flow and damage the motor winding. Similarly, low voltages are harmful for a refrigerator also as these can damage the compressor and motor. Therefore, both the high and low limits are really useful to ensure safety.

The delayed operation of the device at start has added advantages too. During a power failure, if power appears momentarily, the cutout will not switch on. It will wait and watch for about half a minute, and if the power is stable, without trippings, then only the power will be applied. Thus, this cutout provides a true protection, because switching-on transients which are present when power appears suddenly after a long failure are hazardous. It is generally advised to switch off a refrigerator or TV set when power fails, for this very reason. This cutout will do that job automatically.

In particular, this cutout has much relevance in use with a refrigerator. When the running refrigerator is switched off and switched on again immediately, its compressor can get damaged. The refrigerator should not be restarted till the gas pressur inside its cooling system has attained an equilibrium, which may take about two minutes.

If needed, the delay of this cutout can be increased either by increasing R4 (up to 10k only) and C4 also, or by adding one more RC delay network after it. Greater delay is useful with a refrigerator but it will be more of a nuisance while using a TV set, because one will have to wait longer (unnecessarily) for the programme to appear on the screen.

Limitations

This device ensures safety and protection to your gadgets, but will not regulate the power supply. Therefore, if voltage excursions are too much and too often, or if uninterrupted operation is required along with safety, you may use this cutout along with a voltage regulator.

The load current allowable is limited by the relay contact ratings. It should not, therefore, be used with high-power loads as for hot plates and heaters.

Since a transformerless DC power is used, do not interchange live and neutral connections and avoid direct physical contact with the circuit while in use. ☐

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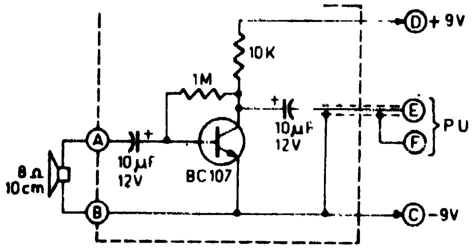
Make Yourself A Multipurpose Intercom

Sandip Das

Here is an intercom system which can also be used for various other purposes. In spite of its special features which are not generally available in the commercial models, it should not cost more than Rs 100 to build, including all its accessories.

The first step in assembling this intercom is to construct a dynamic microphone. A simple permanent magnet loudspeaker may be used for this purpose, as shown in Fig. 1. When someone speaks with mouth near the loudspeaker, the cone vibrates and generates a tiny electrical signal. This tiny signal needs to be amplified so that it can drive the intercom's main amplifier. The 1 megohm resistor in Fig. 1 controls the bias to the transistor and also, to some extent, the negative feedback. The consumption of current is only about 1.5 mA from a 9-volt battery, but an amplification by a factor of about 50 is achieved.



Fir. 1: Dynamic microphone.

The next step is to find a compact, low power consumption amplifier which delivers a moderate output. On surveying the makret, HMV fiesta amplifier was found suitable as it not only met the above-mentioned requirements but was also quite inexpensive. The amplifier's printed circuit board and parts are readily available in most towns.

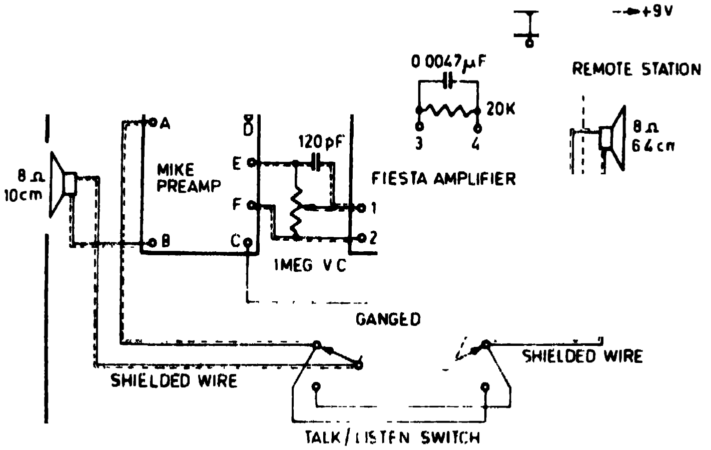


Fig. 2. Circuit diagram for the multipurpose intercom set using the readily available 'Fiesta' amplifier.

It is possible to cut down the cost of this amplifier, without deteriorating its performance in an intercom, by changing some parts and omitting some others. For example, BC158 was tried for transistor T2 (in Fiesta amplifier) in place of the costlier AC125. And the tone control was eliminated altogether in my prototype by installing a 20-kilohm, 1/3-watt resistor between points '3' and '4' of the PCB (Fiesta's circuit diagram is readily available with booksellers specialising in electronics books.)

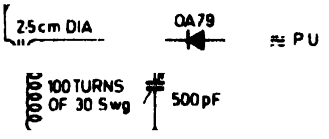


Fig. 3: Tuner circuit needed for the construction of a MW radio receiver.

Now connect the dynamic microphone with the Fiesta amplifier, as shown in Fig. 2. The 'talk' and 'listen' connections with the 'remote' speaker are also shown in Fig. 2. But do not overlook the importance of using a shielded wire for connecting the 'master' set with the 'remote' unit. Otherwise, you might also pick up your local radio station and other electrical interference in the neighbourhood which could disturb your conversation through the intercom.

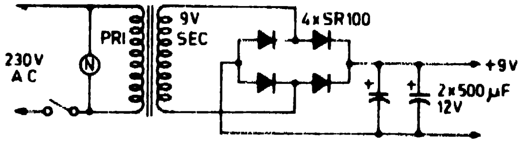


Fig. 4: Battery eliminator circuit which may be used to run the intercom set on AC mains.

Other applications

This intercom can also be used as a baby sitter, 'door-o-phone' or telephone/ electric guitar/ record player amplifier, and with slight modification as a MW receiver. For this, throw the 'talk/ listen' switch to 'listen' position and connect output of the telephone, electric guitar or record player pick-up, whichever's sound you wish to amplify, to the socket for remote speaker.

Its modification for use as a MW radio receiver is illustrated in Fig. 3.

Practical hints

For economy of operation, AC mains supply may be used in place of dry cell battery (Fig. 4).

Since the Fiesta amplifier gives about 1 watt output, a proper loudspeaker of 7.5 to 10 cm size which can handle the output should be used. For the remote station a smaller loudspeaker may be used. The whole master unit can be housed in a box of approximately 15 cm x 15 cm x 5 cm while the remote loudspeaker may be mounted in a much smaller box. □

Applications

- Comparator • DC amplifier
- Integrator or differentiator
- Multivibrator
- Narrow-band or band-pass filter
- Summing amplifier.

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CIRCUIT IDEAS

Economiser for DC Flashlights

There are various types of solidstate AC lamp dimmers in the market these days, but what does one do while using a DC source of supply such as dry cell batteries or storage cell operated emergency lights. The conventional alternative has been a rheostat, which is undesirable as it gets hot in operation and consumes the very power we intend to conserve.

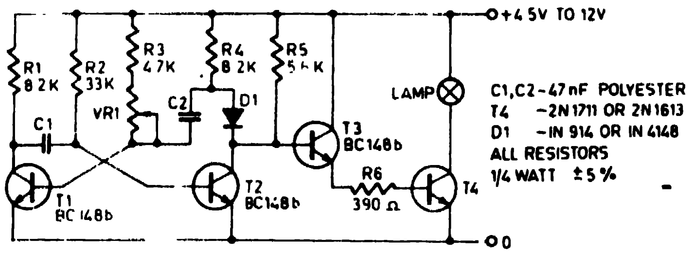


Fig. 1

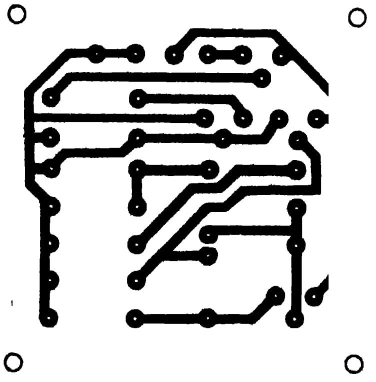


Fig.2

To solve this problem I devised the circuit given here. This dimmer may be used with 4.5 to 12 volt batteries, keeping in mind that the maximum load that transistor T4 can take is 1 ampere. Keeping the basic principle in mind, and using suitable semiconductors, the device may be adapted for use on higher voltages and current.

Transistors T1 and T2 form an astable multivibrator whose duty cycle can be varied by means of potentiometer VR1. The diode improves the rise time of the resultant square wave. Via T3 the multivibrator switches transistor T4, which in turn switches on the lamp. Since T4 is operating as a switch, no special cooling will be found necessary for it. With the components used, the control range is three to one, i.e. at the minimum brightness the lamp would burn at one third of its normal intensity; that means the batteries would last three times as much.

Though no special construction skill is necessary, as the circuit is very simple, yet for those who want to give beauty and neatness to their gadjet a printed board layout is given. And in case you are willing to experiment with the circuit, I suggest you replace potentiometer VR1 with a suitable light-dependent resistor so that the brightness of the lamp would be inversely proportional to the ambient light where the LDR is placed.

—P.K. SOOD

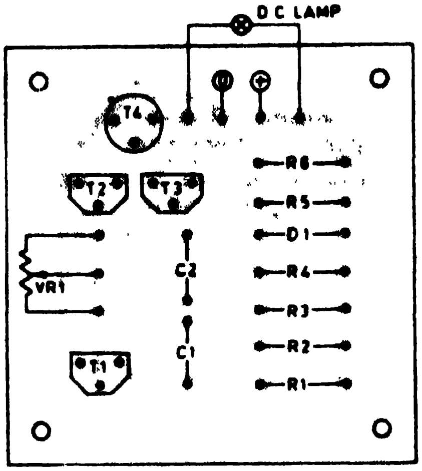


Fig 3

A Simple Overload Indicator

With power electrical appliances, the fuse may blow off often, and it may be a nuisance for you to replace it frequently. To save yourself from this trouble, you can use the following overload indicator circuit with the supply

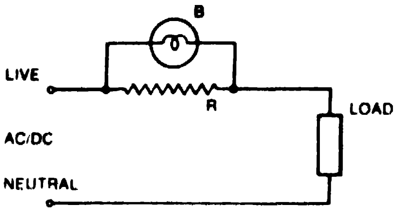


Fig. 1

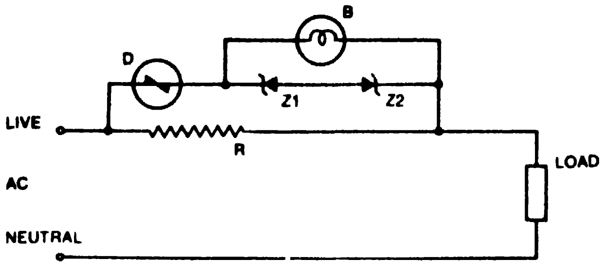


Fig. 3

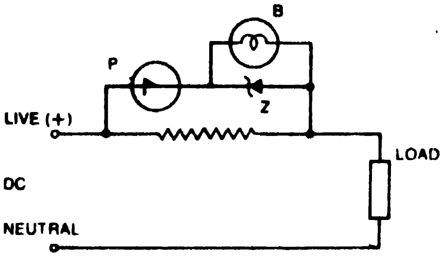


Fig. 2

PARTS LIST

B — 3V, 500 mA torch bulb
R — 0.8 ohm, 20W resistor (see text)
D — 3V, 500mA diac switch for AC
P — 3V, 500mA pnpn diode for DC
Z1, Z2 — 3V zener diode for AC
Z — 3V zener diode for DC
Misc—Connecting wires, mounting board etc.

lines so that you may take preventive measures before the fuse blows off.

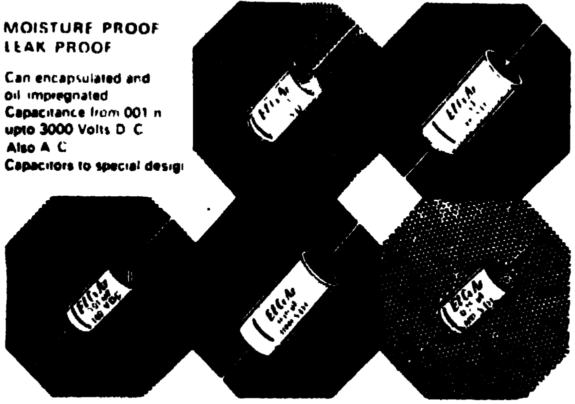
The basic circuit is shown in Fig. 1. All you have to do is to tap a small voltage from the supply line across a small resistance. The resistance should be so chosen that when the line current exceeds a certain value, the voltage drop across the resistance is sufficient to make the bulb glow brightly.

Usually, the household supply lines carry fuse wires of 5-amp rating which permit up to 1100-watt load at 220 volts (at unity power factor for AC). For a 3-volt torchbulb to glow at a current little less than 5 amp, the resistance should be 0.8 ohm with a dissipation capacity of 20 watts. A suitable length of a rejected heatercoil (about 3 cm), if you have any at your disposal, may be used as the resistance. The exact length may be easily found experimentally. The circuit is suitable for both AC and DC.

It may be noted that the bulb in this circuit starts glowing from a low value of the load current (about 2 amps) and glows brigher and brighter with increasing load current. It may be difficult to distinguish between a harmless mild glow and a bright glow denoting overload. Besides, there is risk of damage to the bulb in case of accidental short circuit or sudden heavy overload.

The circuit for the overload indicator may be freed from this defect with the help of a pnpn diode to exclude mild glow at a low load current and a zener diode to protect the bulb, as shown in Fig. 2. For AC supply, it may be noted that the current flows through the bulb in this circuit through one half of each cycle. Hence, the value of the resistance may be doubled. However, it leads to a greater dissipation. Instead, a diac switch may be used in place of the pnpn diode and two zeners in series in place of one, as shown in Fig. 3.

—HIRANMAY GHOSE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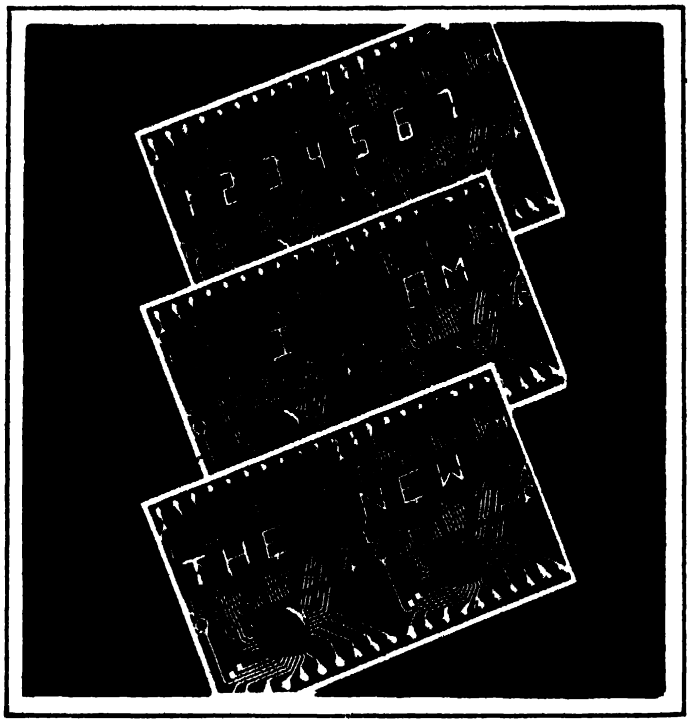
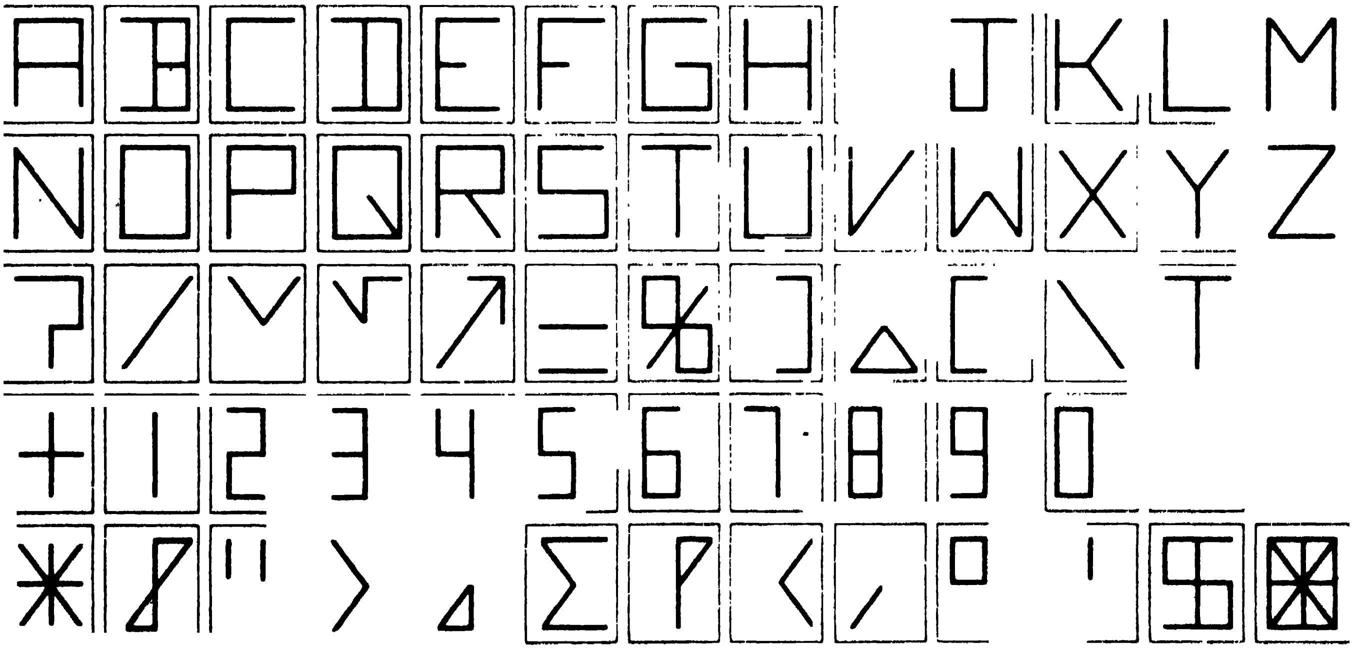
ALPHANUMERIC LED DISPLAY

The entire alphabet from A to Z, all digits from 0 to 9, plus, minus, equals and summation signs and a whole series of other symbols may be depicted by a 16-segment display, which Siemens is now putting on the market under the designation HA 4041. This LED display offers an alphanumeric set comprising 64 characters each four millimetres high. Four such displays are combined on one module with the associated electronics. The modules can be arranged in rows of practically unlimited length.

The co-called segment displays with three horizontal and four slightly sloping vertical bars are well-established in a wide field of applications ranging from measuring instruments to TV sets and watches and clocks of all sizes. Liquid crystals and oblong light-emitting diodes are equally suitable as the display medium, but conventional 7-segment displays essentially provide for the ten digits only.

The new HA 4041 module incorporates extensive electronics for four 16-segment displays, which should markedly increase the presentable information. Each module contains a decoder for the 64-character ASCII set, a multiplexer, a memory and the LED driver stages. Externally, the circuits behave like a RAM device, the operating voltage of 5 V permits easy interface with, for example, TTL.





A very significant feature is compatibility with microprocessors, which could now learn to 'talk' with the aid of the 16-segment displays — an economically unjustifiable proposition so far: the alphanumeric character set permits the display of operating states and program progress. A related application would be in keyboard stations or phototypesetting equipment, where the typed information could be displayed for checking purposes before it is printed.

Each of the four display units of a module puts out 0.1 mcd per segment with a viewing angle of 20° from all sides. Up to 16 displays (four HA 4041 modules each with a width of 25 mm) may be lined up as an array, while more than 16 displays can be combined with modest circuit requirements. The module packages are designed to present an evenly spaced display, also when used in arrays. □

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CEDT—The Centre for Electronics Design and Technology

K.R. Srinivasan and A.V. Shah

There has been a rapid growth in the number of small and medium sector industries in electronics in the last one decade or so. Even though their growth has been quite impressive, many of the units still tend to be extremely fragile and do not have the necessary infrastructure.

Recognising the paramount need to bridge this gap, the Indian Institute of Science, Bangalore has recently established a new centre in cooperation with two world-renowned Swiss federal institutes of technology (ETH and EPF). This centre, known as the 'Centre for Electronics Design Technology (CEDT)' is believed to be the only one of its kind in the country. It has been set up to work as a close link between the Indian Institute of Science and Indian electronics industry. The centre is supported by the Department of Electronics, the University Grants Commission and the Swiss service for technical cooperation.

Postgraduate diploma course

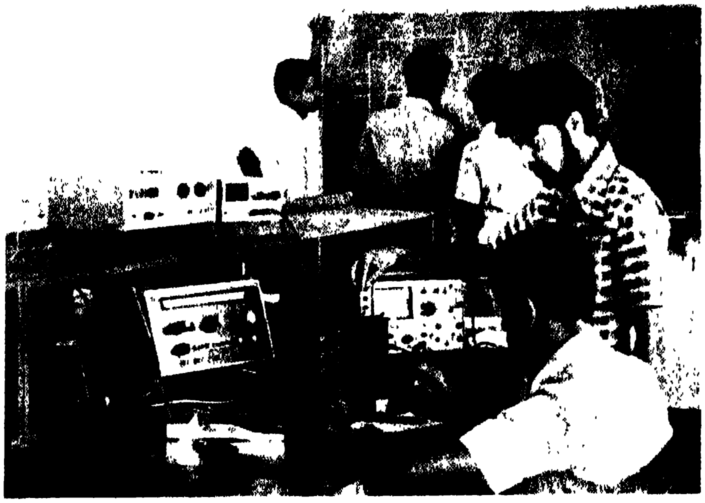
The main objective of the centre is to train engineers from industries and R&D organisations in the area of electronics design and fabrication. Selfemployed engineers and prospective entrepreneurs with adequate experience are also admitted to this centre.

The centre conducts a postgraduate diploma course of roughly one year duration in Electronics Design and Technology. The course is heavily practice- and project-oriented; special emphasis is laid on projects related to vital sector of the economy, such as power generation and distribution, public transportation, essential communications environmental instrumentation and other related fields.

Fabrication technology

Special emphasis is given at CEDT to fabrication methods (for printed circuit boards, anodised multicolour front plates etc) which are specially suited for small-scale industries in India and have a low capital-to-workplace ratio. These emphasise the use of indigenous materials and equipment and guarantee professional quality.

The CEDT not only trains engineers in these fabricational processes, but also develops its own new processes that are especially suited to Indian conditions. Furthermore, it provides consultancy services, particularly to small-scale firms, in production technology. As a back-up in the field of production methods, the CEDT has also set up a Technician's Training Programme of 35 weeks duration, which is planned for the period January — September of every year and is intended to help create a highly skilled cadre of electronics technicians who can manufacture equipment in a professional manner.



There is a close cooperation between students and staff at CEDT in all practical and theoretical courses conducted for engineers from industries.

The centre also conducts short-team intensive courses of two to three weeks duration periodically on topics of current interest to cater for the immediate needs of industries, universities and other organisations.

The most important fabrication process in electronics industry is that of printed circuits. CEDT has completed a fabrication set-up for high-resolution double-sided printed circuit boards (PCBs). The PCB facilities of the CEDT, which cost around Rs 150,000, serve as a model for many small- and medium-sized industries and engineering colleges.

Equipment design

In tne first three years of its operation, the centre has so far trained about 30 engineers in the area of electronics design and technology—from both industries as well as R&D organisations. During the one year they spent at CEDT, they each brought a design project of their own selection to the stage of production prototype.

An interesting case is that of a digital multimeter developed by Mr N.R. Joshi, a new entrepreneur, who came

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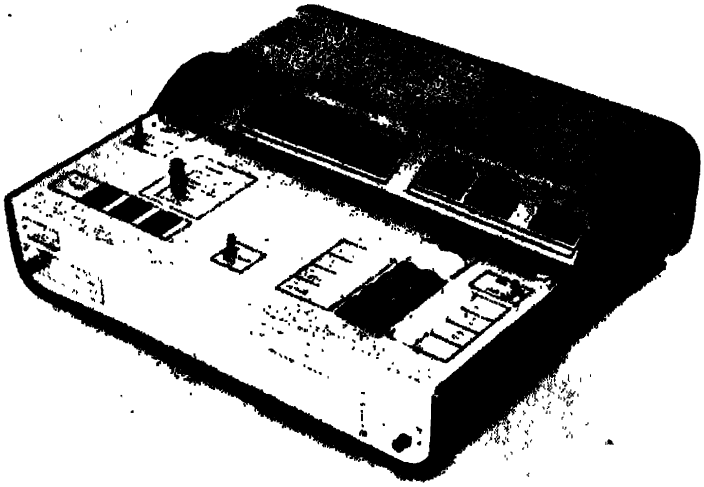
The authors are with the Centre for Electronics Design Technology, Indian Institute of Science, Bangalore 560012.



Microcomputer trainer developed by a small-scale industrialist, Mr K.S.R.K Sastri, as part of the CEDT Postgraduate Diploma Course. The cabinet was designed by Mr S. Vijay Kumar of National Institute of Design, Ahmedabad.

to CEDT to get the necessary background for setting up his own small-scale firm (INDIGIT) which is just now going into production in Pune. At CEDT, Mr Joshi designed and built a prototype of his first instrument made under the guidance of CEDT staff.

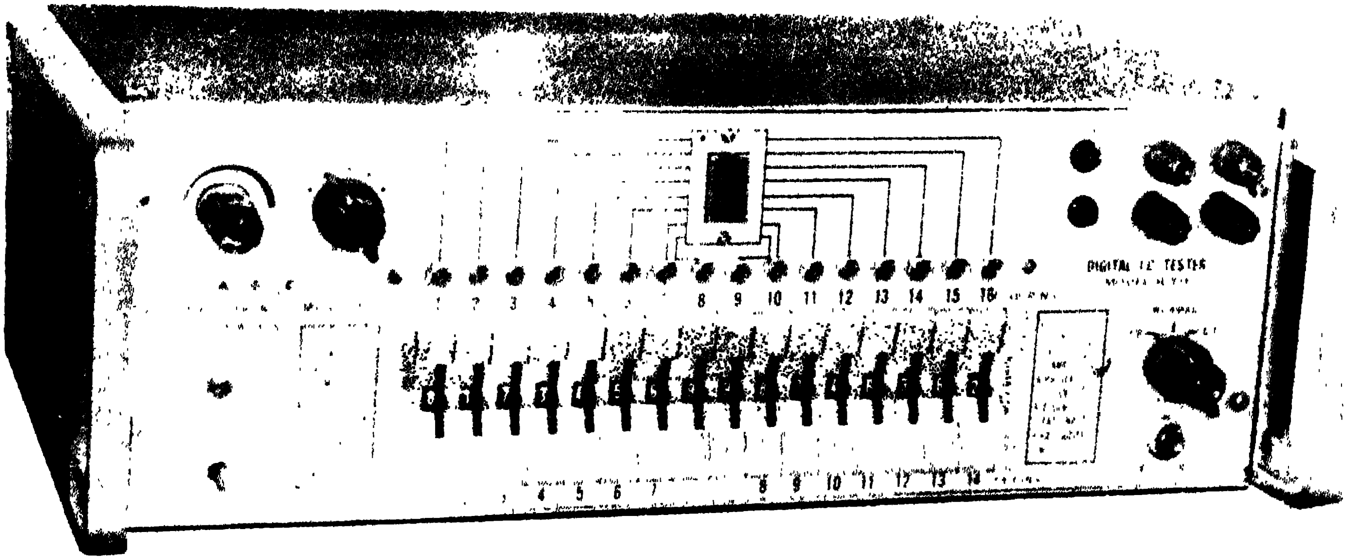
His digital multimeter with 3½ digits and automatic range switching, polarity indication and automatic correction of large mains frequency/ voltage fluctuations has an accuracy of better than 0.1% and capability to measure DC and AC voltages, DC and AC currents and resistance.

Mr Joshi's digital multimeter was designed in cooperation with Mr Arun Khanna, a senior design student from the National Institute of Design (NID), Ahmedabad who participated for some time in the CEDT programme. Its circuitry uses an unvonventional method for performing high accuracy analogue to digital conversion and also for eliminating mains pick-up even when the mains frequency varies substantially. The instrument uses almost 100% local components.

With the knowhow that he gained at the CEDT, Mr Joshi was able to get his instrument fully ready for production and come out in the market almost at the same time as his firm was founded.

Another interesting product developed by a self-employed student is that of microcomputer trainer using the Intel 8080 chip. The trainer consists of a keyboard and several numeric displays. It is suited for understanding the operations of the microprocessor, studying the development of small programmes, testing and debugging programmes, interrupt techniques and interfacing peripheral devices. The CEDT student entrepreneur Mr K.S.R.K. Sastri of Allied Electronics, Madras has already been able to book a good number of orders for this product; the item is just now going into production in his firm. □

DIGITAL INTEGRATED CIRCUIT TESTER—Model ICT-1



This functional and pulse parametric digital IC Tester is completely self-contained and manually programmable. It is designed to test and analyse ICs under actual operating conditions before they are assembled in circuits. It can test all gates and functions like flip-flops, multivibrators, decoder-drivers, counters, shift-registers, multiplexers, adders, LED displays etc. Tests open-collector gates also.

For details, contact :

ALLIED ELECTRONICS MFG. CO.,
337 THAMBUCHETTY STREET, P. B. NO. 203, MADRAS-600001.
Telephones : 422269, 423368 & 445904

AN INTRODUCTION TO COBOL PROGRAMMING (2)

R. Ramaswamy and T.V. Krishnamurthy

Cobol data consist of variables and constants. Data names, procedure names, condition names etc, can be treated as variables, since their values vary during the progress of a program. A constant is a predetermined unit of data whose value does not change during a particular program. There are two types of constants, namely, literal and figurative.

Literals

A literal is a constant, i.e., it consists of a string of characters which represent themselves. A program may demand the use of a data name to have a constant value throughout the run-time of the program. For example, if we have a factory code number to be output by the program, then the factory code number can be fed into the computer as a data name with a constant value throughout. This is done by defining the factory code as a literal before the factory name is used in the program. There are two types of literals, namely, numeric literal and non-numeric literal.

Numeric literals

Constants consisting only of numbers are called numeric literals. They can be used in a mathematical operation in a program without being defined previously, though the general rule is that all data names shall be defined earlier to their being used in the program. For example, in the statement

ADD 10 TO A or (MOVE 10 TO A)

A is a data name representing a definite value. The number 10 in the instruction is a numeric literal. When A is defined previously, 10 is taken as a constant for this mathematical operation. The second instruction, MOVE 10 TO A, causes a number 10 to be moved into the location A. Suppose we want to multiply the contents of a location B by a constant and store the result in another location C, the instruction for this can be as

MULTIPLY B BY 5 GIVING C

where B and C are defined previously, before they are used in this instruction. The constant 5 is used without being defined previously. Such numeric constants used in the program without being defined prior to their being used are known as 'numeric literals.' A numeric literal shall conform to the following rules:

1. It shall contain up to a maximum of 16 digits. (Count does not include decimal point or sign)
2. A positive or a negative sign can be given preceding the first digit in the literal. An unsigned numeric literal is taken as positive. If a sign is shown as the left-most character, there must be no blank left between it and the literal's next symbol.
3. A decimal point can lie within the literal. The decimal point shall not be the last character of the literal. Numeric literals without decimal point are treated as integers. Twentyfive can be written as 25 or 25.0, but not as 25.
4. A literal shall not contain alphabets or any special characters.
5. There are no double precision or complex literal constants.
6. Only numeric literals may be used in arithmetic.

   The following are examples of valid numeric literals:

   +3245
   -32.90
   3456
   23.09
   -.00089

   The following are examples of invalid numeric literals:

3245+	The + sign cannot be at the end
2345.	The last character shall not be a decimal point
32/23	There shall not be any special character
23A45	There shall not be any alphabets

Non-numeric literals

A non-numeric literal is a string of characters enclosed with quotation marks. In a program it may be necessary to use certain constants which contain alphabets or special characters as well. For example, it may be necessary to output a certain value as CR-AMOUNT = 326.20, where 326.20 is the amount computed by the program. If the result is just output as 326.20, it becomes difficult to decipher as to what it stands for. To cause the output to be meaningful, the word CR-AMOUNT followed by a = sign is also ouput. This word CR-AMOUNT and the sign = are called non-numeric literals. These non-numeric literals are moved into a previously defined location and the contents of the location are output. That is, one writes

MOVE "CR-AMOUNT = " TO X

The above instruction causes the word "CR-AMOUNT = " to be moved to a location X which has been defined previously. Here the word "CR-AMOUNT = is treated as a non-numeric literal constant. It is essential that the non-numeric literal constant shall be enclosed by a set of quotation marks. The following are the rules to be observed in forming a non-numeric literal.

1. It can contain up to a maximum of 120 characters including blanks.

2. It shall contain only the characters in the Cobol character set.
3. The constant shall be enclosed with quotation marks.

The following are examples of valid non-numeric literals:
" ITEM DESCRIPTION"
"JANUARY 24, 1978"
"25.5"
"ERROR-MESSAGE"
The computer on sensing the quote marks recognises the characters following it (until it senses a closing quote mark) as forming a non-numeric literal. The name non-numeric literal must not be understood as only defining alphabets and special characters as constants, but it can also define a numeric field. For example, if one writes

MOVE "001" TO C

this causes 001 to be moved into a previously defined location C. The difference between such a non-numeric literal defining a numeric field and a numeric literal defining a numeric field lies in the fact that the latter is subject to any mathematical operation such as addition, subtraction, division or multiplication whereas the former is not. Consider the following two instructions

MOVE 10 TO A
MOVE "001" TO C

With the first instruction it must be possible to give another instruction as ADD 1 TO A at a later stage in the program. This causes the value of A to be increased to 11. With the second instruction it is not possible to give an ADD instruction at any later stage. If C is to assume a value 5 at any stage, an instruction as, MOVE "005" TO C shall be specified. Thus it is not possible to subject locations whose contents are non-numeric literals to any mathematical operations.

Figurative constants

Some constants are so frequently used that reserved words have been assigned to them. They are referred to as figurative constants.It may be necessary to move zeros to a location or more spaces to a location. It is not necessary to use zeros or spaces as literals. Instead we would use the figurative constants. A figurative constant is a Cobol reserved word which has a value assigned by the Cobol language itself. Zeros and Spaces are examples of figurative constants. When a particular location A is to be filled with zeros, one writes,

MOVE ZEROS TO A

This results in the previously defined data field A to be filled by all zeros. This has the status of both the numeric and non-numeric literal in the sense that the data name A can be subject to further mathematical operations. Similarly, when a location A is to be filled with spaces an instruction as MOVE SPACES TO A will fill the data field A with blanks. This helps us to clear and initialise data fields. There are many figurative constants like Upper-Bound, Lower-Bound, High-Value, Low-Value, Quote etc.

Cobol sentences, statements, paragraphs and divisions

In natural languages the sentence is the smallest construct capable of expressing ideas and in computer languages the constructs analogous to sentences are called statements. All computer programs are made up of combination of statements. A statement indicates some instruction or command. The following are examples of some valid Cobol statements

ADD 7 TO X
COMPUTE X = A +B
IF A EQUALS B

A statement is also called a clause in Cobol. A Cobol sentence consists of one or more consecutive statements or clauses ending with a period. A Cobol sentence is also called an entry. Only blanks and commas are used to separate the statements. The next sentence in Cobol must be started after leaving one or more blanks after the period which terminates the previous sentence. The following are examples of valid Cobol sentences.

ADD 7 TO Y, GO TO END-PARA.
COMPUTE X = A + B.
IF A EQUALS B MOVE C TO D.

It must be noted that the statements do not have any ending periods whereas sentences end in periods. Statements are separated either by a space or by a comma.

In Cobol a sentence by itself has no syntactic meaning. It is merely a convenience to the programmer. A group of sentences that may be related in function form a paragraph. In Cobol only a paragraph represents a syntactic unit which can be referred to in a transfer of control statement. In Cobol only a paragraph can be labelled (and not each statement as in Fortran). Of course a paragraph can contain only one statement or sentence, but normally a paragraph contains more statements or sentences which pertain to the same though or computation. Cobol allows structures called sections. A section is a group of paragraphs and is headed by a label called a section name followed by the word SECTION and a period. A section ends at the next section name or at the ned of the program. Paragraphs are physically separated by line spaces as in English language. Fortran has no larger structure than a statement except a program itself or subprograms. A Cobol program has got named divisions, which are composed of named sections, which in turn are composed of named paragraphs consisting of sentences or entries which in turn are composed of statements or clauses. These formalisms will be discussed in greater detail when the actual programs are explained.

Cobol coding form

Cobol programs are punched in 80-column cards according to a special format. A standard coding sheet for writing

Cobol programs is provided to reflect the 80 column card. Columns 1 to 3 are used for page numbers, columns 4 to 6 are used for line numbers in that page and columns 73 to 80 are used for some identifying information meaningful to the programmers. None of the above columns need be used and, in general, the beginners can ignore them. Only columns 7 to 72 are used for punching Cobol programs. Two margins are indicated in the coding form. The A-margin is at the column 8 and the B-margin is at the column 12. Procedure names or paragraph names are written beginning from the A-margin, but other lines of paragraphs are written from the B-margin.

Sentences are not written beyond column 72, but may be continued on the next line if necessary, and also on additional lines if necessary. If a sentence is to continue on the next line, it may be broken between words or data names, leaving one or more blanks at the end of the line. The continuation of the sentence is begun from the B-margin on the next line after placing a hyphen in column 7 of the continuation line. Each sentence is written in each line in the coding form and each line in the coding form is punched on one card. Though more than one sentence can be punched in one card, provided the total length does not exceed 66 columns, it is good practice to punch only one sentence per card, since it is more difficult to correct a key-punch error in the middle of a paragraph than in the middle of a sentence. ☐

To be continued next month

HIGH QUALITY
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EHT Valve Bases for DY 802
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Solidstate EHT Rectifier Bases
9-pin and 8-pin Valve Bases
Aluminium Caps for EHT Transformer
Plastic Covers for DY 802
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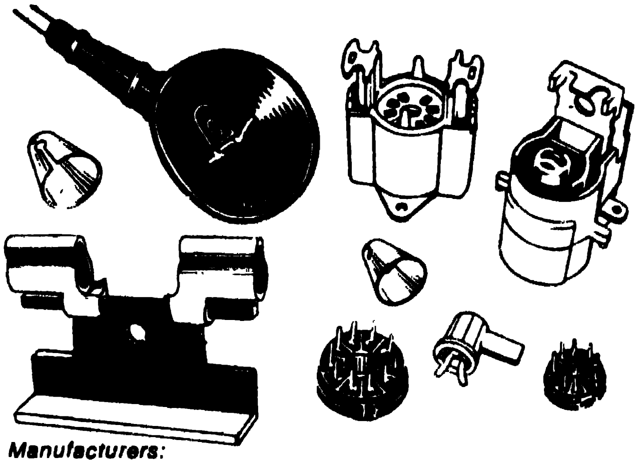
Rectifier Fittings for Solidstate 31cm TV



Manufacturers:
TELEVISION SERVICE CENTRE (Regd.)
Saraswati Marg (Below Telegraph Office),
Karol Bagh, New Delhi-110005
Phones : 567552/560076

MULTICHANNEL COMMUNICATIONS TAPE RECORDERS
SHR SERIES

The Multichannel Communications Tape Recorders developed by the BRG Hungary ensures the continuous and reliable recording of informations, reports and instructions in the following fields of application:

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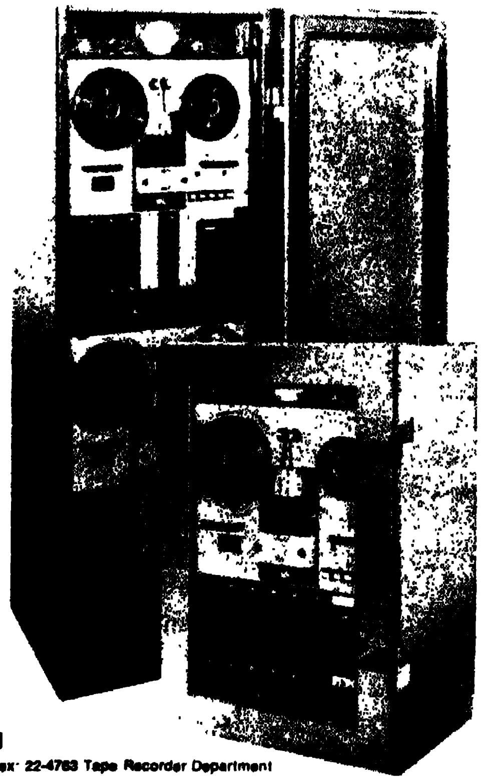
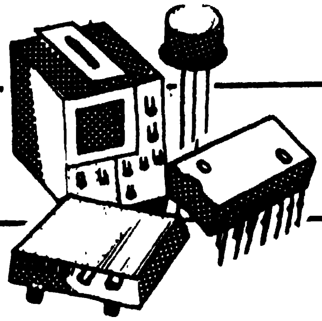


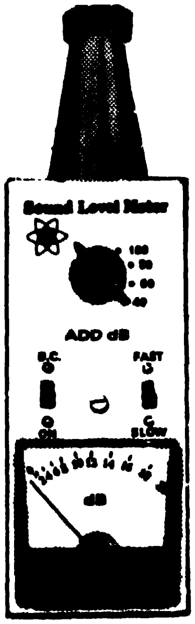
VIDEOTON — INDUSTRIAL FOREIGN TRADING CORPORATION
1376 Budapest P.O.B 567 1066 Budapest VI. Szofia u 6. Phone: 229-821, 229-686, 229-484 Telex: 22-4763 Tape Recorder Department



PRODUCT PROFILES

SOUND LEVEL METER

PEC miniature, portable SLM 101 is designed for accurate yet simple sound level surveys. The standard instrument has a built - in microphone mounted in a cone shaped front for minimum reflections. The instrument responds as per the 'C' weighing network. Solidstate and miniature components used give it a small size and low weight for continuous measurements without fatigue.



The instrument has a built in constant impedance attenuator with 20 dB steps and a minimum signal - to - noise ratio. Its meter is a large scale moving coil instrument calibrated between 0 and 20 dB. A Fast-Slow switch enables even short sound bursts to be measured. The instrument operates on a 9V battery. A switch permits easy battery check. Price Rs 2250.

Contact: Arora Enterprises, 8Bank Shopping Centre, Bajwa, Baroda 391310.

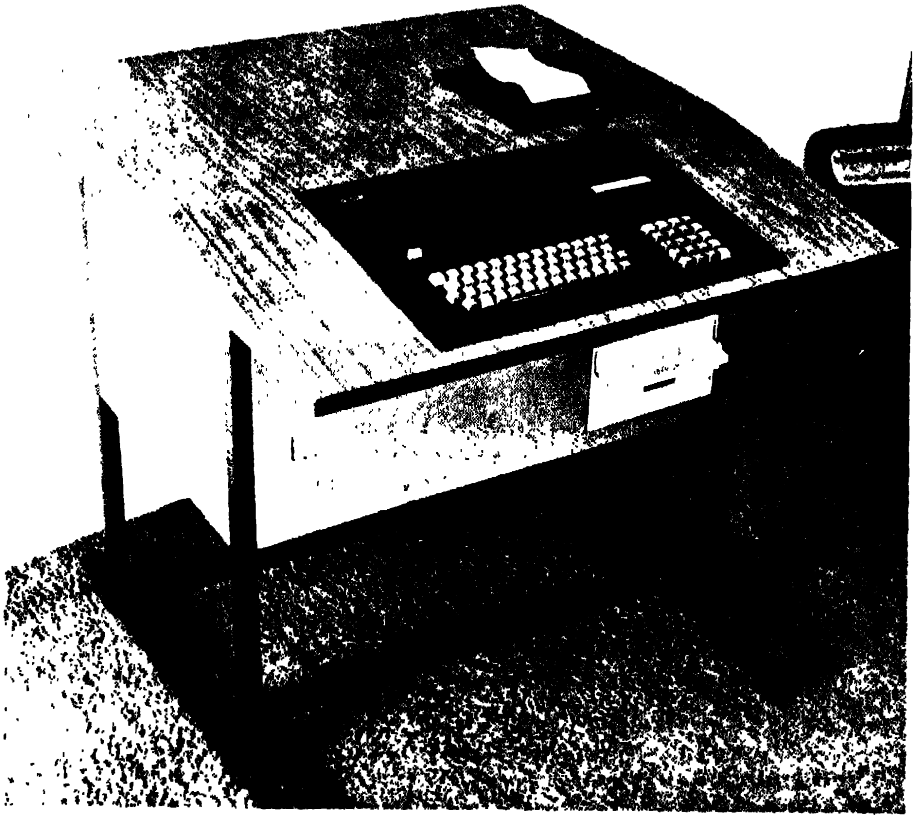
DATA PROCESSOR

Spectrum/1, a data processing machine for scientists, statisticians and engineers, which makes use of the easy - to - use programming language BASIC and powerful peripherals is now being made by DCM Data Products. It can handle many problems done on big, expensive machines.

Spectrum/1 has 8-bit microprocessor based processing unit, 1k bytes ROM memory, up to 28k bytes RAM memory and 4k or 8k user memory. The memory access time is 0.35 microsecond. It has 73-key alphanumeric keyboard with 20 character rolling alphanumeric display. Its 40 - column dotmatrix type alphanumeric printer has 64 character set and approximately 60 lines per minute speed; can use paper roll with 57.2 to 98.6 mm width giving 1 + 1 copy of printout.

The machine has a floppy disk drive with transfer rate of 30k bytes/sec. Capacity per diskette: 243k bytes formatted. Direct memory access feature enables faster data transfer from memory to floppy disk.

Contact: DCM Data Products, 1st Floor, Kanchenjunga Bldg, Barakhamba Road, New Delhi 110001.



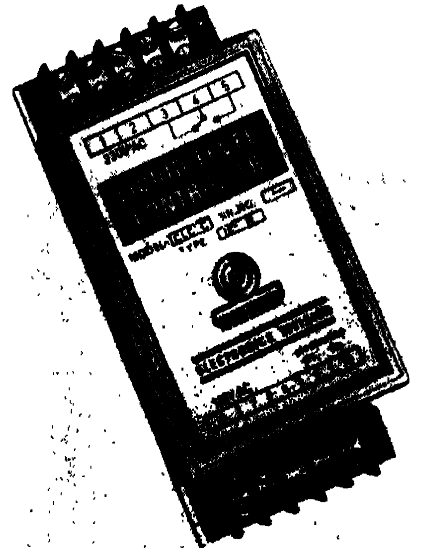
TUBELIGHT INVERTER

The Aargee tubelight inverter is ideal for fluorescent lighting applications in transport vehicles, demonstration vans, emergency lighting, boats and campsites. The transistorised inverter utilises contemporary solidstate silicon technology and operates on 12V DC or 24V DC. It provides the required power to light a fluorescent tubelight at high frequency and high efficiency. Since it operates at a high frequency, it gives more luminosity. The light is flicker-free and there is no stroboscopic effect. Operating at high efficiency also results in less current drain from the battery and hence longer life.

Contact: Aargee Industries, 304 Old Madras Road, Dooravaninagar, Bangalore 560016.

LIQUID-LEVEL CONTROLLER

Advani-Oerlikon now offers type CLC-C liquid level controllers for conducting liquids. They use ICs to make them compact and reliable. These liquid level controllers are suitable for supply voltage of either 230V AC or 110V AC. Output contact ratings: 230V AC, 5 amperes.

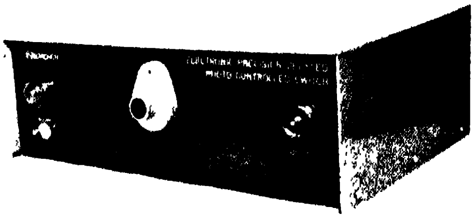


The output of the device can be interphased with high-power pumps and other controls via one set of NO and NC changeover contacts.

Contact: Advani-Oerlikon Limited, Electronics Division, Akurdee Village, Chinchwad, Pune 411019.

PHOTO CONTROLLED SWITCH

The Neltronics' delayed photo controlled switch automates and smoothens the functioning of different kinds of the latest packaging machines such as form/fil sealing machines, blistered packing machines and print registered sachets. The basic instrument is housed in a tiny metallic box provided with controls on the anodised front panel. It is designed and fabricated with the latest techniques, using ICs, SCR and FET devices.



The instrument can automate packaging at a rate as high as 40 bags per minute. The output contract rating is 5 amperes. It consumes hardly 5 watts and operates on 230V AC.

Contact: Neltronics, 4351 Gujar Lane, Ahmednagar 414001.

FLOPPY DISK SYSTEM

Intersil, Inc., California has announced a new flexible (floppy) disk programme development system, 6970-IFDOS, for use with its IM6100 CMOS microprocessor-based intercept prototyping system. The purpose of the 6970 - IFDOS, together with the Intercept system and an ASCII terminal, is to provide rapid software development ofr M6100 CMOS microprocessor - based systems.

The 6970-IFDOS consists of two interfaced floppy-disk drive mechanisms with all electronics, power supplies and cables necessary to add more than 4 million bits of on-line mass storage to the Intercept prototyping system. All components are packaged in an enclosure which can be rack or tabletop mounted, and plugs into Intercept. It provides IBM 3740-compatible media with multiple sources, and is fully software compatible with the DEC RX8 flexible disk system for the PDP-8/E minicomputer.

The software components contain a file system, a keyboard monitor, a text editor, an assembler, binary loader, octal debugger, high level language interpreter, and numerous utility programmes.

Contact: Zenith Electronics, 541 Panchratna, Mama Parmanand Marg, Bombay 400004.

LOGIC PROBE & PULSER

Networks now offers pen-shaped logic probes and pulsers for comfortable handling for long periods. The Networks probe NP3 can detect pulses as narrow as 15 ns and then stretch them for viewing to 50 ns. This, combined with an unambiguous twin LED display, allows the user to follow logic levels, intermittent and normal pulse activity through digital circuits.

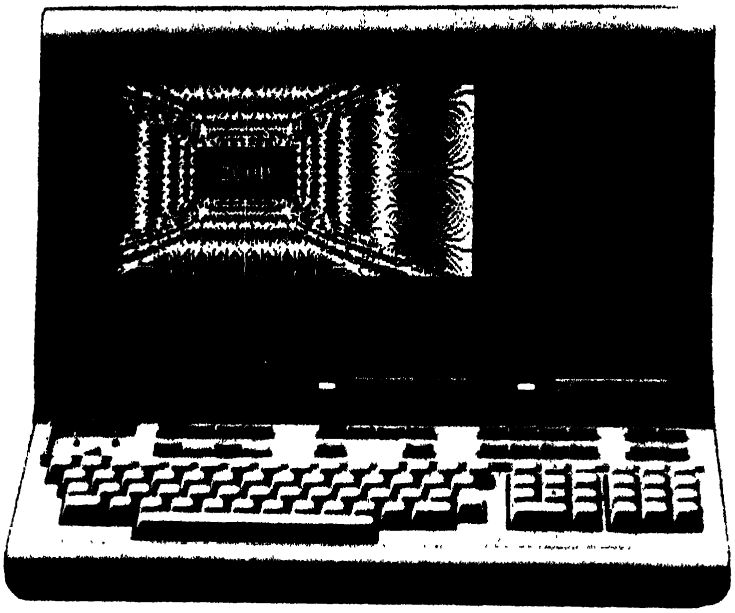
The Networks pulser NLP6 solves the problems of pulsing digital ICs in-circuit. Pressing a button on the pulser body automatically drives for a brief period all circuits (outputs as well as inputs). NLP6 is essentially a single-spot pulse generator. Its ability to source or sink up to 0.5 ampere enables it to override IC outputs in high and low states.

Contact: Networks Pvt Ltd, 113/121 Swaroop Nagar, Kanpur 208002.

GRAPHICS TERMINAL

The new HP 2648A microprocessor - controlled graphics CRT terminal, using raster scan technology, features a bright and easy - to - read display, selective erase, independent graphics and alphanumeric memories, automatic plotting of tabular data, rubber-band line, system - independent zooming and panning. Although specifically designed for graphics applications, the 2648A also has the data entry and data communications capabilities of the proven HP 2645A display station.

The standard 2648A terminal has 8k



bytes of semiconductor memory allotted to alphanumerics which is expandable to 12k bytes. Sixteen 16k RAMs provide a 360 X 720 dot resolution in the graphics display.

Zooming and panning the image is a major feature of the terminal and can be done with a single keystroke without support of a CPU. Any portion of the graphics memory can be magnified up to 16 times to permit investigation, modification and redrawing of especially dense areas.

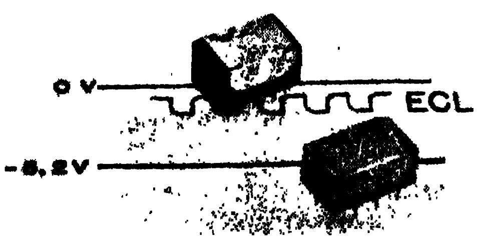
The unit's 12.7 cm X 25.5 cm display presents data in a 24-line by 80-column format and provides clear and easy - to - read alphanumeric characters using 9 X 15-dot character cells.

Contact: Test & Measuring Instruments Dept, Blue Star Limited, Sahas 414/2 Vir Savarkar Marg, Prabhadevi, Bombay 400025.

DIP ECL CLOCK

The CO-633 DIP compatible crystal oscillator operates from −5.2V DC and provides a stable ECL compatible output at any specified frequency in the 5-125 MHz frequency range. Initial accuracy of type CO-633A is ± 50 ppm while that of the CO-633B is ± 10 ppm. Stability of each type is ± 25 ppm over 0° C to + 70° C. Package size for 14 pin DIP compatibility is 12.7X20.3X12.7 mm.

Options include the MIL range CO-633-2 with stability of ± 50 ppm over −55° C to + 125° C and the CO-633-3 which provides ± 3 ppm over 0-50° C. Further, while the standard model is packaged in a plastic case, a fully sealed metal can version is available.



Contact: Vectron Laboratories, Inc., 166 Glover Avenue, Norwalk, Connecticut 06850, USA.

DIGITAL MULTIMETER

The Dana model 5940, 5½-digit, ratiometer features 4 ranges of AC reference and 4 ranges of AC signal input (1, 10, 100, 1000 volts). These 8 input ranges allow the user to test a wide variety of circuits and voltages. The instrument also features switchable front and rear input and switchable AC or DC coupling on the AC converters. Both the input and coupling configuration are front panel switchable and/or remotely programmable.

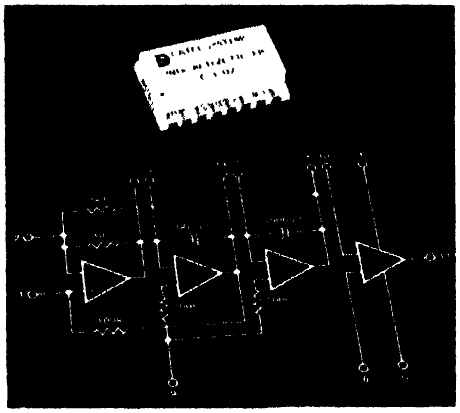
With a base price of $ 3495, model 5940 has particular application for those performing transformer, servo, gyro, accelerometer, amplifier gain testing or applications where AC/AC ratio measurements are required. It also has 5 DC ranges with accuracies of ± 001% of full scale (10 ppm), 8 ranges of resistance and 4-wire/4-quadrant DC ratio. The inputs are protected up to 1000 volts on all voltage ranges.

Contact: Trans Marketing Pvt Ltd, Sterling Centre, 16/2 Dr Annie Besant Road, Bombay 400018.

ACTIVE FILTER

The FLT-U2 is a new universal hybrid active filter which uses three operational amplifiers to obtain a second order transfer function. Lowpass, bandpass and high pass transfer functions are simultaneously produced at its three output terminals. A fourth uncommitted op amp is included which can be used as a gain stage summing amplifier, buffer amplifier or to add an independent pole to the function. These op amps have 3MHz gain bandwidth products coupled with low noise performance. An accuracy of 5% is obtainable for a frequency range of 0.001 Hz to 200 kHz with a Q range of 0.1 to 1000.

The FLT-U2 has a ± 12V input range and a ± 10V output signal range, making it compatible with other components such as operational amplifiers, analogue multipliers, sample-holds, and A/D converters. Operating from a wide power supply range ± 5V to ± 18V, the device is housed in a 16-pin ceramic DIP. The operating temperature range is 0° C to 70° C.



Contact: Echbee Corporation, 38 Cawasji Patel Street, Bombay 400001.

COMPANY PROFILES

ETTDC Expands its Activities

Electronics Trade and Technology Development Corporation Limited (ETTDC), a public sector organisation set up in August 1974 under the Department of Electronics, with the main objectives of fostering foreign trade and indigenous technology in the field of electronics, completed its third year of operations on July 31, 1977. During 1976-77 its annual turnover increased from Rs 18 million to Rs 65 million with a profit before tax of Rs 2.6 million. ETTDC hopes to build up a trade volume of over Rs 100 million during the current year, including export of about Rs 15 million.

The items so far imported by ETTDC include selected raw materials and components such as integrated circuits, special transistors, high-voltage rectifiers and resistors, diodes, deck mechanism for tape recorder industry and special copper wire to help particularly small industries, and calculator chips and TV picture tubes as canalised items. Special tape recorders, nuclear scanners, high-frequency receiving tubes, computers and computer peripherals etc are also imported.

The corporation is now exporting about 20 items including voltage stabilisers, components, electronic test and measuring instruments, scientific calculators, computer software etc to countries such as Bulgaria, Canada, Hungary, Iraq, Iran, Kenya, Kuwait, Poland, the USA, the UK, the USSR, and West Germany. Collaborations with foreign partners in third country joint ventures for supply and erection of sophisticated communications systems like satellite earth stations, microwave communication system are being processed. Special steps are being contemplated to build up trade in far away countries like Australia and Newzealand and to set up a fully owned subsidiary in Los Angeles in the USA for the promotion of exports.

ETTDC arranged at its head office in New Delhi an exhibition from 27th to 30th January, 1978 for displaying the products being handled by it and those which are under development for large-scale exports.

The technology development wing of the corporation has expanded its activites considerably to provide effective support for export. Several short-term and long-term developmental projects to produce additional exportable items and to achieve import substitution have been undertaken during the last year, some in collaboration with industries also.

An electronic business and accounting machine developed and displayed in the exhibition is ready for production. The development of such machines is expected to bring considerable returns to the corporation by marketing them in this country and abroad. This is ETTDC's first venture for a large scale import substitution in the country. Electro - mechanical type of accounting and invoicing machines are presently being imported by the corporation from eastern Europe.

The development of a data line monitor is also expected to be completed very shortly. The other projects under development for export promotion include an AM/FM receiver, two-in-one and three-in-one combination sets, telephone subscriber instrument meeting CCITT specifications and a low-cost TV.

Special efforts are being made to

Mr R M Nayar, managing director of the Electronics Trade & Technology Development Corpn Ltd (ETTDC), New Delhi, showing the electronic products on display in an exhibition held recently by the corporation to Prof. M.G.K. Menon, chairman of the Electronics Commission and of the ETTDC, on January 30. 1978.

launch shortly export-oriented production ventures. A few of such projects for the manufacture of electrolytic capacitors, cheap TV and computer memory stacks are likely to be set up in various states in the country. Possibilities of production cooperations for the export of TV tubes, consumer electronics, transreceivers, electronic calculating and accounting machines and allied components are also being explored with Egypt and Yugoslavia.

The corporation has undertaken the activities related to transfer of technologies in the field of electronics in the country and abroad. Action has been initiated to transfer the technologies developed by ISRO group of laboratories and through the development projects funded by Technology Development Council of the Electronics Commission. Attempts are being made to explore the possibility of rendering consultancy services in third countries. ETTDC has been recently recognised by UNDP as a specialised consultancy organisation in electronics.

Semcon Electronics Breaks New Ground

The February 1978 issue of SPAN—a monthly published by the United States Information Service in New Delhi—carried an interesting article on Semcon Electronics which is currently producing 10,000 diodes a day in a unit located in SEEPZ (Bombay) in collaboration with Micro Semiconductor Corporation in Santa Ana (USA).

Semcon proposes to produce, besides biodes, such other electronic components as plastic devices, hybrid circuits, computer core memory diode arrays etc. The company is planning to multiply its output five-fold from 10,000 diodes a day to 50,000 diodes a day; all of them are to be exported.

Semcon gets all the raw materials—silicon chips, glass sleeves, tungsten slugs, copper leads—from Micro Semiconductors and does not pay for them as all the output is being exported to the collaborator. However, if Semcon starts supplying its products to others, it will have to pay to Micro for the raw materials.

Philips-Ericsson-Bell 70 Consortium

The government of Saudi Arabia has accepted the tender of the consortium of Philips—Eindohoven (Holland), L.M. Ericsson—Stockholm and Bell—Canada for the extension of the country's automatic telephone network designed to add 470,000 new lines to the existing system. The tender is considered as the most competitive in all aspects. The project which will take about three years to complete, covers the installation of Philips' PRX and Ericsson's AXE representing the very latest in stored programme control techniques together with the operation and maintenance of the system for a period of five years by Bell-Canada. The Philips-Ericsson part in the project, to be shared equally, will amount to approximately 2,000,000,000 US dollars (Rupees seventeen thousand & two hundred million). This is the biggest ever order for telephone exchange on record so far in any country. A substantial protion of this amount will be spent inside Saudi Arabia on labour, materials and equipment.

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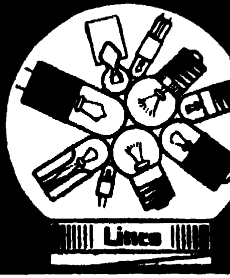

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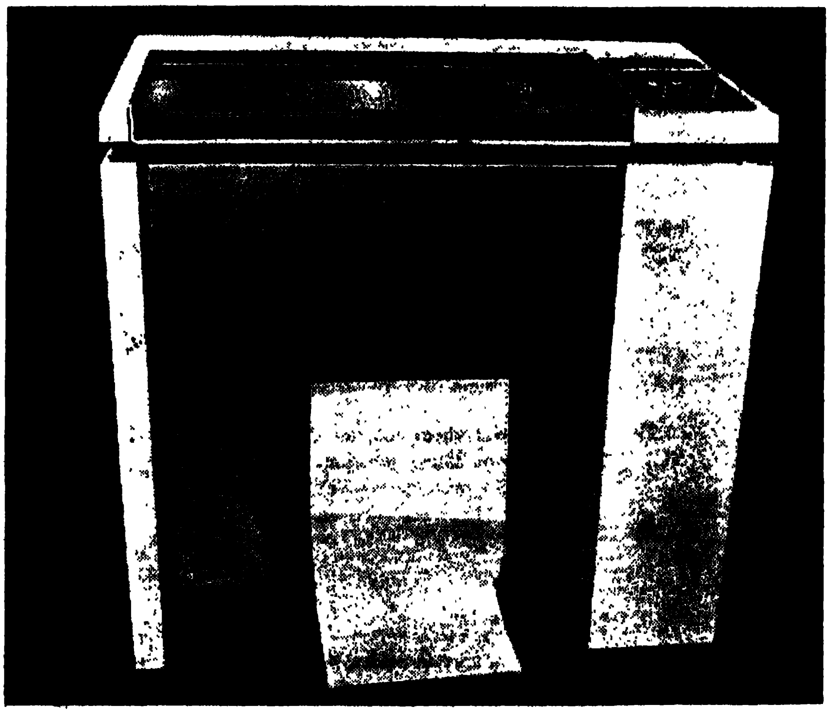

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Licences & Letters of Intent

The following licences and letters of intent have been issued to electronics firms under the Industries (Development and Regulation) Act, 1951 during the months of September and October 1977.

Name & Address of the Applicant and Location of the Undertaking (1)	*Date & Type of Licence* (2)	*Articles manufactured* (3)	*Quantity per annum* (4)
LICENCES			
Protecto Engg. Pvt Ltd, Beaumon Chambers, 27/33 Medows Street, Bombay 400023. (Kandivli-Maharashtra)	2.9.77 (NA)	*Drafting aids for electronic printed circuits* 1. Black tape and diecut products 2. Red and blue tape and diecut products (each roll will be of 20 metres of tape or 150 diecut products)	 40,000 rolls 10,000 rolls
Punjab Bio-Medical Equipments Ltd, D-33 Indl Focal Point, Sahib Zada Ajit Singh Nagar, Mohali. (Mohali-Punjab)	8.9.77 (NU)	1. E.C.G. 2. Foetal heart detector 3. Echoscope and flaw detector	200 nos. 500 nos. 50 nos.
Power Systems and Projects Ltd, Palghat, Kerala.	8.9.77 (NA)	1. Power line protective relay equipment 2. Power system data transmission equipment	100 nos. 100 nos.
Gujarat Semiconductros Pvt Ltd, 17/1 Gunj Bazar, Visnagar (N. Gujarat). (Mehsana-Gujarat)	9.9.77 (NU)	1. Low-power silicon junction diodes 2. High-power silicon junction diodes (30 amps and above)	300,000 nos. 20,000 nos.
Devidayal Electronics & Wires Ltd, Gupta Mills Estate, Darukhana, Reay Road, Bombay 400010. (SEEPZ-Maharashtra)	9.9.77 (NA)	Telephone answering devices	100,000 nos.
Integrated Components Pvt Ltd, 12-A Chakraberia Road, North, Calcutta 700020. (Hyderabad-Andhra Pradesh)	13.9.77 (NU)	Lead frames, encoder, discs, watch parts, flat springs, motor laminations fluidic elements etc for electronic industries	30,000 sheets (38 cm x 66 cm)
Bharat Heavy Electricals Ltd, 18-20 Kasturba Gandhi Marg, New Delhi 110001. (Bangalore-Karnataka)	13.9.77 (NA)	Thyristor power converters	150 sets
Punjab Display Devices Ltd, A-27 Phase VII, SAS Nagar, Near Chandigarh. (Ropar-Punjab)	13.9.77 (NA)	Cathode ray tubes	5000 nos.
Keltron Resistors Ltd, Keltron House, Vellayambalam, Trivandrum 695001. (Cannanore-Kerala)	22.9.77 (NU)	Carbon film resistors	25 million nos.
National Radio and Electronics Co Ltd, Unity House, 8 Mama Parmanand Marg, Bombay 400004. (Bombay- Maharashtra)	22.9.77 (NA)	High speed data acquisition and control systems, including signal conditioners, scannars, A/D & D/A converters, linearisers, signal comparators, programmable controllers, DVMs, interface units & accessories	17 nos. (Rs 25 million)
General Electric Co of India Ltd, 6 Chittaranjan Avenue, Calcutta 700013. (Calcutta-West Bengal)	22.9.77 (NA)	Induction heating equipment	18 nos.
Kerala State Electronics Development Corporation Ltd, Keltron House, Vellayambalam, Trivandrum 695001. (Trivandrum-Kerala)	25.10.77 (NA)	TV camera	100 nos.

(1)	(2)	(3)	(4)
Hind Rectifiers Ltd, Lake Road, Bhandup, Bombay 400078. (Bombay-Maharashtra)	25.10.77 (NA)	Silicon power transistors (5 amps and above)	100,000 nos.
Elpro International Ltd, 'Nirmal', Nariman Point, Bombay 400021. (Poona-Maharashtra)	28.10.77 (SE)	1. Intensifying screens	15,000 pairs (after expansion)
		2. Fluoroscopic screens	1200 nos. (after expansion)
LETTERS OF INTENT			
Delhi Cloth & General Mills Co Ltd, Unit: DCM Data Products, Shivaji Marg, New Delhi 110015. (Delhi)	8.9.77 (NA)	Data entry system	400 nos.
J & K State Industrial Development Corporation Ltd, Haft Chinar, Srinagar (J&K). (Srinagar-J&K)	(SE)	HF/VHF transreceivers	4800 nos. in sets
Indian Telephone Industries Ltd, Dooravani nagar, Bangalore 560016. (Bangalore-Karnataka)	(SE)	1. Microwave radio equipment (RFB-KMS)	9000 nos. after expansion (exist. 2000 nos)
		2. Coaxial line equipment (RKMS)	2000 nos. after expansion (exist. 1650 nos.)
		3. Multiplexing equipment	
		(a) Bays	1200 nos. after expansion (exist. 1200 nos.)
		(b) Groups	3000 nos. after expansion (exist. 2200 nos.)
		4. *Interstices* carrier cable line equipment	
		(a) Bays	100 nos. (exist.)
		(b) Groups	250 nos. after expansion
		5. VFT equipment (channels)	3000 nos after expansion (exist. 3000 nos.)
		6. Defence equipments	
		(a) FDM boxes	Rs 25 mn after expansion (exist. 25 mn)
		(b) ADM (channels)	4000 nos. after expansion (exist. nil)
		7. PLCC equipment (terminals)	50 nos. after expansion (exist. nil)
		8. Telemetery equipment/ Supervisory remote control equipment (systems)	50 nos. after expansion (exist. nil)
		9. Road traffic signalling equipment	Rs 1 mn after expansion (exist. nil)
		10. Field telephones	10,000 nos. after expansion (exist. 7000 nos.)
		11. Loading coils and unicoils	2,00,000 nos. after expansion (exist. 2,00,000 nos.)
		12. Transformers	1500 nos. after expansion (exist. 1500 nos.)
		13. Special purpose test & measuring instruments for P&T	
		(a) Level meter wide band	50 nos. after expansion (exist 50 nos.)
		(b) Channel selective level meter 600 KHz	200 nos. after expansion (exist 200 nos)
		(c) D.B. meter 35 KHz	500 nos. after expansion (exist. 500 nos.)
		(d) Level meter 150 KHz	200 nos. after expansion

(1)	(2)	(3)	(4)
			(exist. 134 nos.)
		(e) Naval telephones	**200 nos. after expansion** **(exist. 90 nos.)**
		(f) Special purpose misc. instruments for P&T	**Rs 5 mn after expansion** **(exist. Rs 5 mn.)**

NA : New Article NU : New Undertaking **SE : Substantial Expansion**

CHANGES & CANCELLATIONS

(This information pertains to particular licences only)

Changes in the Names of Owners or Undertakings

Original Name	*New Name*	*Date & Location*
West Bengal Electronics Industry Development Corpn Ltd, Calcutta 700020.	Webel Video Devices Ltd, 225 E Acharya Jagdish Chandra Bose Road, Calcutta 700020.	9.10.75 (East Bengal)
Shri Damodar Ratha, Bombay	Peerless Fabrikkerne (India) Pvt Ltd, Bombay	11.8.77 (Maharashtra)
West Bengal Electronics Industry Development Corpn Ltd, Calcutta 700020	Webel Jyoti Power Electronics Ltd, Calcutta	5.4.77 (West Bengal)

Licences Cancelled during September 1977

Name of the Undertaking	*Items of Manufacture*	*Date of the Licence & Location*
Apar Pvt Ltd, New Delhi	Carbon resistors, potentiometers etc. (Cancelled)	19.9.73 (Gujarat)

Letters of Intent Revoked & Lapsed during September 1977

Name of Undertaking & Location	*Items of Manufacture*	*Date of Licence*
Radio & Electrical Mfg Co Ltd, Bangalore. (Karnataka)	Indicating instruments	3.8.74 (Lapsed)
UP Electronics Corpn Ltd, Lucknow. (U.P.)	Piezo-electric crystals	31.1.75 (Revoked)

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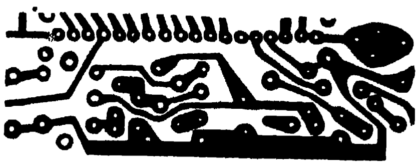

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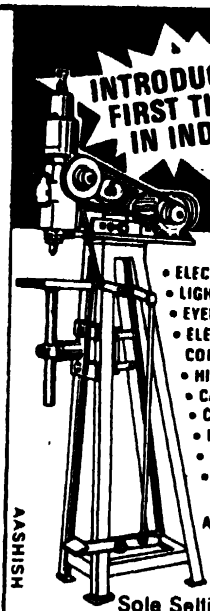

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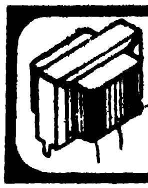

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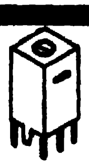

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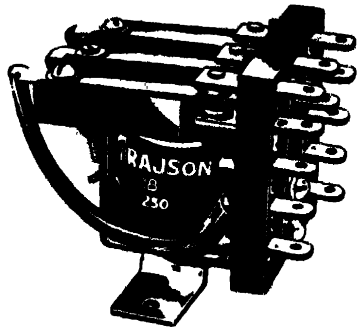

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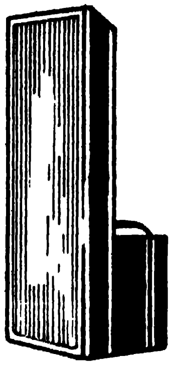

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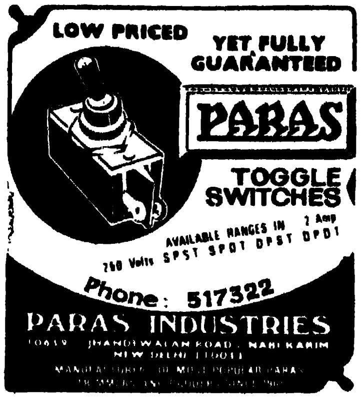

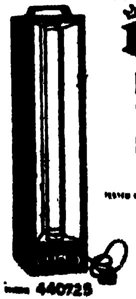

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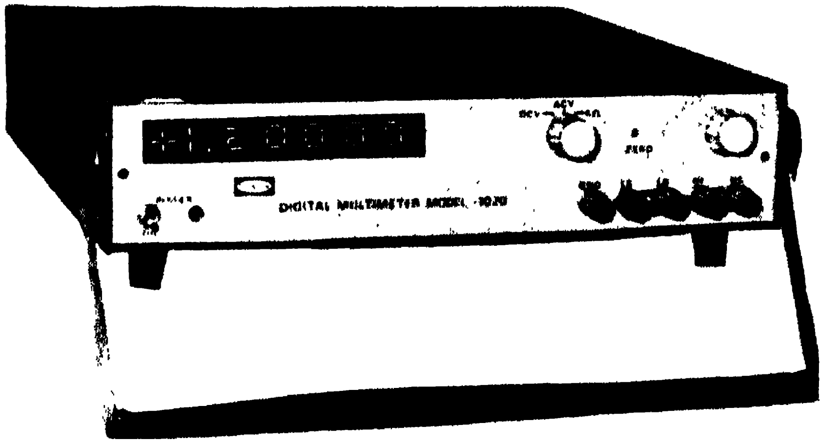

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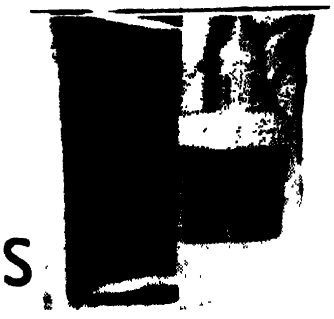

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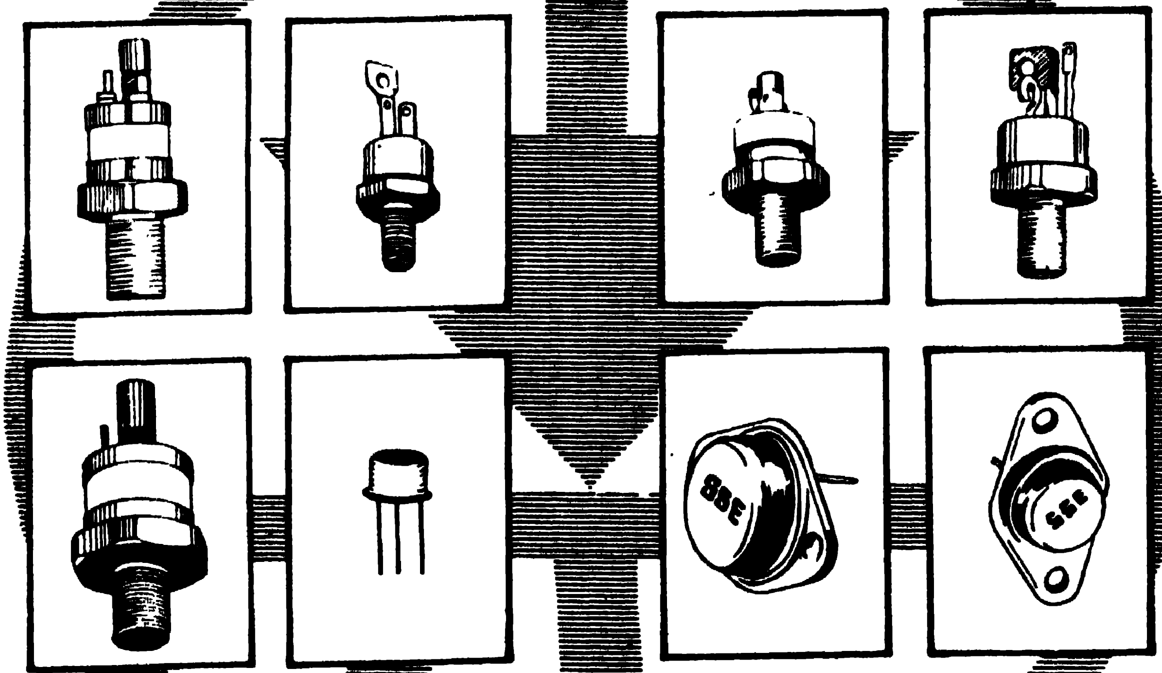

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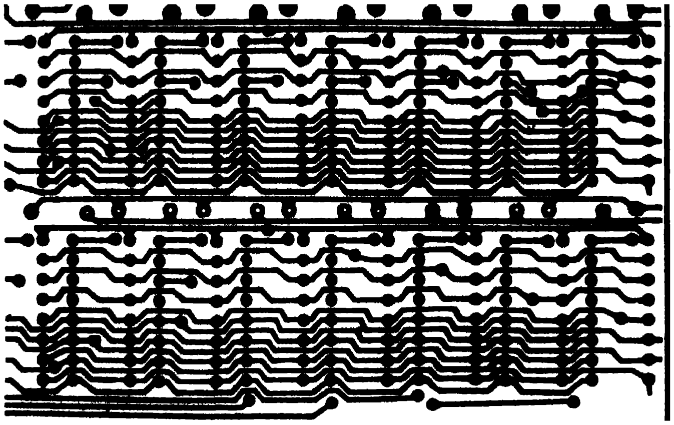

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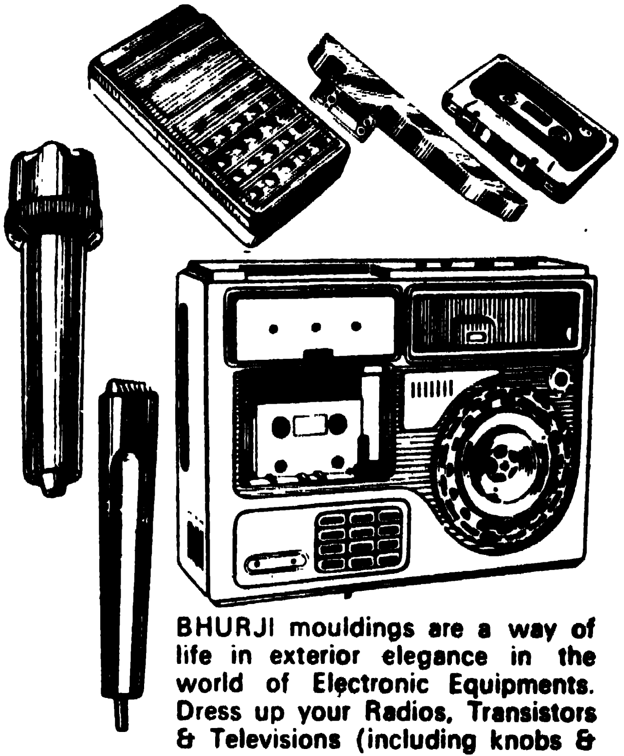

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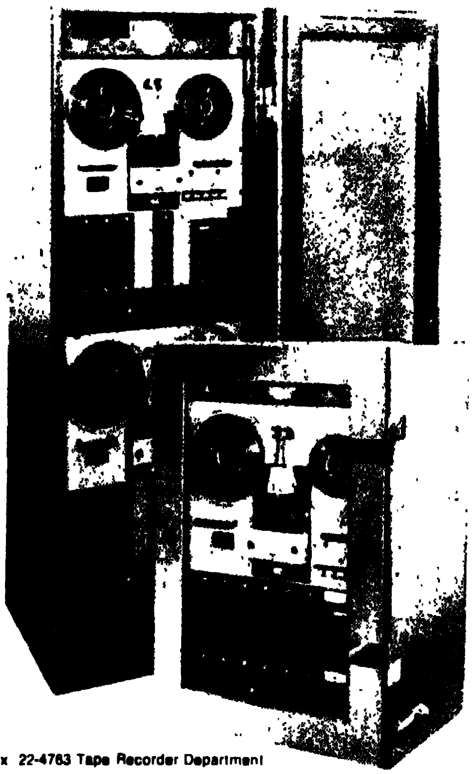

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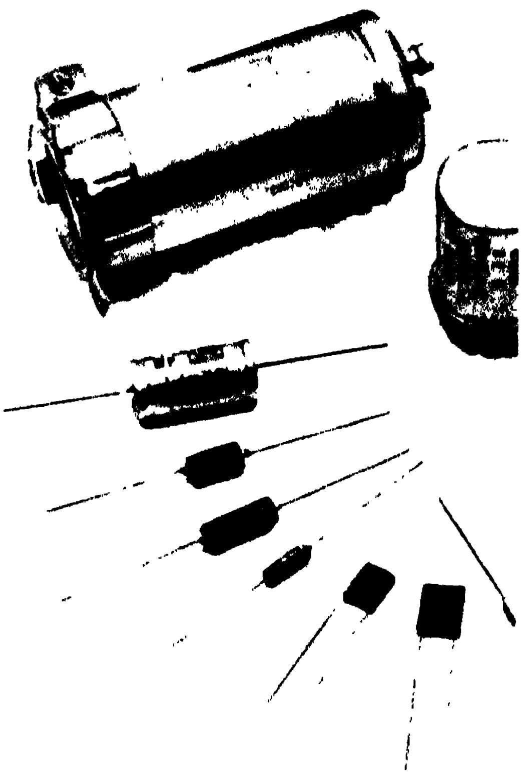

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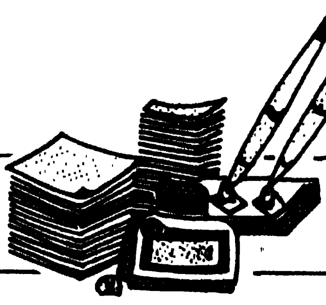

EDITORIAL

A MISTAKE

"Big people make big mistakes." This was the spontaneous comment of an experienced journalist in New Delhi when he learnt that the Verghese Committee had recommended raising of the annual licence fee for a radio from Rs 15 to Rs 25 and for a TV set from Rs 50 to Rs 75.

It may be stated that Mr B.G. Verghese, chairman of the working group on autonomy for Akashvani and Doordarshan, is a renowned journalist. He was the editor of the Hindustan Times for a number of years. The report of this group, released recently, is currently being debated in the press and also through other media. The recommendation which has irked the electronics industry is the one relating to the raising of the licence fees.

The logic relating to this suggestion, to all intents and purposes, is very simple. The economists in this country are agreed that more than half of the population of this country lives below the poverty line, implying that their incomes are not large enough to provide nutritious food to keep body and soul together.

Consequently, those who live below the poverty line have no potential for yielding additional tax revenue for the government. It is the population which lives above the poverty line which can be taxed to swell the coffers of the government of India.

And among the not-so-poor sections of the population, there are groups in the top income brackets which form five to ten per cent of the total population and which can be milked generously through additional tax burdens. This leads to the conclusion that any one having a radio set or a TV set is rich in the midst of sprawling Indian poverty. As if the existing burden of direct and indirect taxes was not enough for these so-called affluent sections of society, the Verghese Committee has suggested further enhancement of the licence fees.

During the emergency, the annual licence fee for a TV set was raised from Rs 30 to Rs 50. Since it was supposed to hurt the better-off section of society, no one shed any tears. And the new tax was quietly borne—without a murmur. The Verghese Committee, while making suggestions for introducing autonomy in radio and television management in this country, had a fling at the radio and TV owners—assuming once again that no one would raise a finger against such a proposal.

The electronics industry was the first to raise its voice against this suggestion. Within a few days of the release of the Verghese Committee report, the sixth AREA Convention was held in New Delhi. The spokesmen of the electronics industry vehemently opposed the suggestions of the committee to raise the licence fees. And they offered cogent arguments in support of their contention.

TV is no longer an item of luxury, said the electronicsmen. It performs a number of useful purposes. The lessons imparted to school children through TV have come to occupy an important position in the educational programme of the country. And the children who draw benefit from these programmes belong to all sections of society, and not necessarily to the rich sections of society. Then there are educative programmes for the rural folks. Both through radio and TV, new knowledge about agricultural practices is being communicated to rural familes. The doctors speak to the people on diseases and practices for countering them.

And what about the future of the electronics industry? Why should the government first grant licences to entrepreneurs for setting up units of this industry and then impose such burdens as would cripple them? Why should the hand which is supposed to cradle this industry, be used for stifling it? Is raising of additional tax revenue the solitary aim of the government, ignoring its impact on the future of the industry? These are some of the questions which the government must answer before accepting the suggestions of the committee.

Perhaps the radio and TV have already hit upon the jackpot for the government through phenomenal fees for commercial broadcasting. The advertisement revenue of radio and TV exceeds every year Rs 80 million with possibilities of further growth, though Mr H.M. Patel has put in a knife in this year's budget by imposing a tax on publicity and advertising. There is every probability that both radio and TV will be affected the least. Surely, the scope for raising revenue through commercial broadcasts is immense and what is needed is not raising of the licence fee on radio sets but scrapping them completely. The number of radio sets, according to P & T Department, in this country ranges between 17 and 18 million. Its number has been growing but slowly because the new radio sets are being bought by families in rural areas where the facilities for renewing the licences are not easily available.

In the case of the radio set, there is a positive case for scrapping the licence fee, and the proposal to raise the licence fee for a TV set is fraught with harmful consequences for the TV industry.

Unpredictable are the ways of the clever and the eccentric! The members of the Verghese Committee have earned epithets which do no justice to their unquestioned scholarship. But the electronics industry could perhaps do better without catching the eye of these scholars and pundits in our midst.

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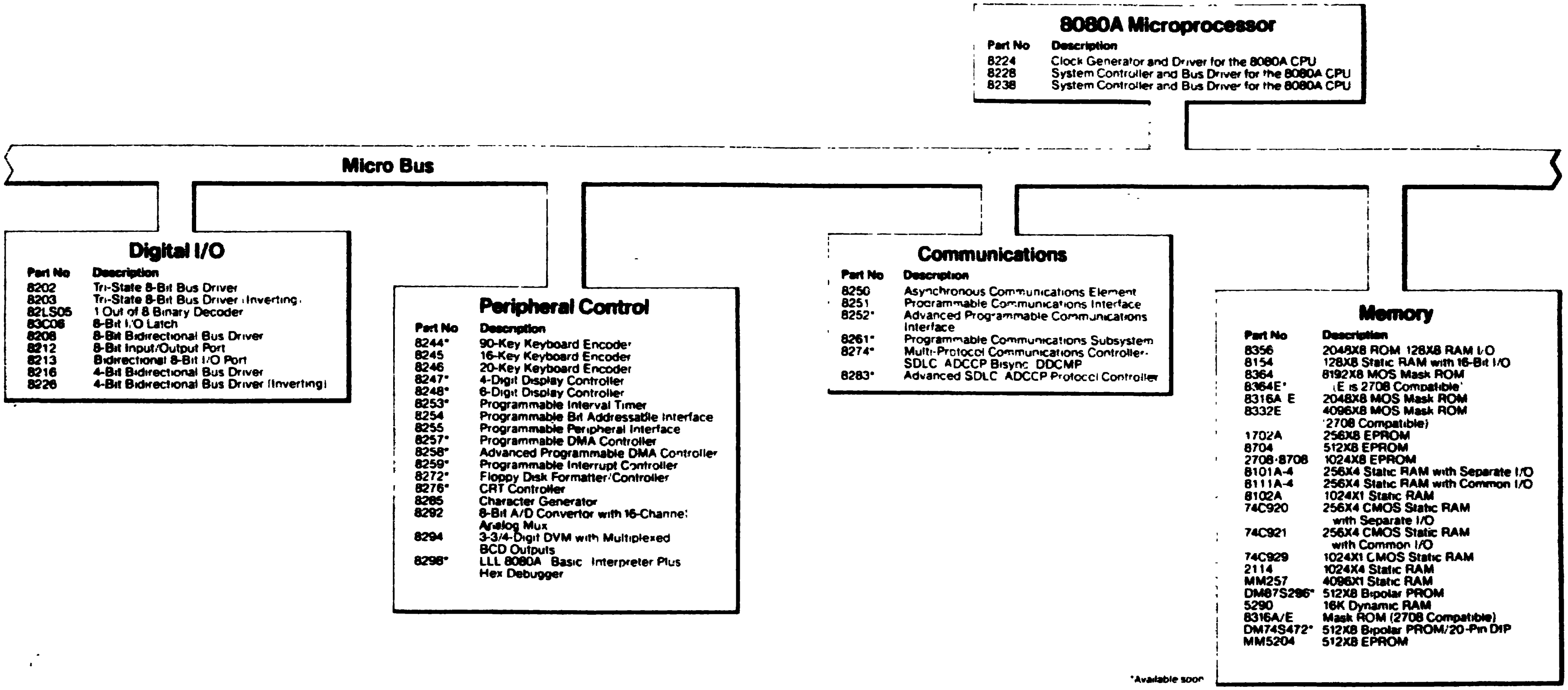

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8238	System Controller and Bus Driver for the 8080A CPU

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82LS05	1 Out of 8 Binary Decoder
83C06	8-Bit I/O Latch
8208	8-Bit Bidirectional Bus Driver
8212	8-Bit Input/Output Port
8213	Bidirectional 8-Bit I/O Port
8216	4-Bit Bidirectional Bus Driver
8226	4-Bit Bidirectional Bus Driver (Inverting)

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8246	20-Key Keyboard Encoder
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8248*	6-Digit Display Controller
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8254	Programmable Bit Addressable Interface
8255	Programmable Peripheral Interface
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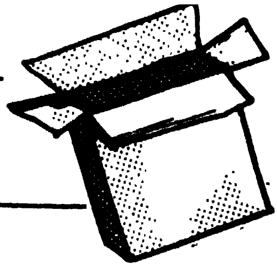

WHAT'S NEW

In India ...

Panel for Electronics Exports

A committee under the chairmanship of Prof. M.G.K. Menon, who is also chairman of the Electronics Commission, has been set up to suggest ways and means to boost electronics exports. According to Mr Mohan Dharia, Union commerce minister, the committee may be expected to submit its report within two months. Mr Dharia disclosed this while inaugurating a seminar on 'Export Promotion, Imports and Technical Knowhow for Developing Countries' organised by All India Radio and Electronics Association. He assured, the government would take follow-up action on the report within a reasonable time.

Mr Dharia said he had been receiving frequent complaints from foreign countries against the inferior quality of Indian items being exported. He said the government had decided to do away with the Quality Control Act and would like to see the industry apply self - certification, though with increased control by the Export Promotion Council. He, however, warned that due care would be taken of the defaulters under the law.

New Units Coming Up in SEEPZ

Of the 38 approved applicants for setting up units in Santacruz Electronics Exports Processing Zone, 23 had already commenced production by February 1978. The zone officials expected seven more units to come up before the end of March.

Eighteen of the 23 units now in production were listed in the special supplement on Electronics Exports (pages 35-36) published with the March 1977 issue. The five new units set up since then are: (i) Badri Narayan Saha to manufacture mica capacitors, (ii) Unomat India Ltd for electronic flash guns, (iii) Wellman (I) Ltd for core memory stacks, (iv) Computer Automation (I) Pvt Ltd for computer components and sub-assemblies, and (v) Peerless Fabrikkerne for loudspeakers. Apart from these, the Ahuja Radios unit set up earlier is now functioning under its new name: Unisound (P) Ltd.

Total exports from SEEPZ during 1976-77 were worth Rs 30.06 million. From April 1977 to January 1978 exports from the zone amounted to about Rs 33 million.

A SEEPZ office is expected to be set up in San Fransisco or California for regular trade contacts with the business community in the USA. According to Mr Alexander S. Borinovich, executive director, international trade department of San Jose Chamber of Commerce, California, who was recently on a visit to the SEEPZ, many top electronic firms in the USA were not even aware of a free trade zone in India. The SEEPZ office in the U.S. is therefore expected to fill this communications gap.

Working Group Set Up for TV Glass Shells

The ministry of industry, government of India, has set up a working group to go into all aspects of setting up a TV glass shell industry in the country. The working group would examine technological, locational and economic aspects of the manufacture of TV glass shells, examine individual proposals which may be received from entrepreneurs and make appropriate recommendations to the government.

The constitution of the working group became necessary because of the controversy over this project— whether it should be in the public or private sector or whether a TV glass shells unit is at all necessary. The group headed by Mr I. Mahadevan, joint secretary in the industrial development department of the ministry of industry, is expected to submit its report by the end of April.

ETTDC Bags Export Orders from USSR & Rumania

A contract was signed in New Delhi on February 27 between the president of Electronorgtechnica, Dr Scherbina, and the managing director of Electronics Trade and Technology Development Corporation Limited, Mr R.M. Nayar, for the export from India of computer memories for a total value of about Rs 40 million. These memory units will initially be produced by Electronics Corpn of India Ltd, Hyderabad.

ETTDC also signed a contract for import of a Soviet computer for an actual user in India. In addition, a protocol for building up rapidly the both way trade in electronics was also signed between Electronorgtechnica and ETTDC on the same day.

On March 15, ETTDC concluded a contract with Electronum of Rumania for the supply of capacitors for a value of about Rs 3 million. These capacitors will be manufactured by Keltron in Kerala and by Orient Electronics Pvt Ltd, Poona; the supplies will be made within 1978.

ELCINA Getting Report Prepared on Semiconductor Devices

In view of the fact that the field of semiconductor devices has been saturated, Electronic Component Industries Association (ELCINA) has decided to get a report prepared by an independent authority about the demand projections vis-a-vis existing capacities. The report is expected to throw light on the present state of affairs in which most of the units are working far below their licensed capacities, while new ones are entering the field.

The Executive Committee of ELCINA now meets every month, alternating between Bombay and New Delhi, to discuss the various points of interest to the industry. It held its last meeting in Bombay on March 17, and is now scheduled to meet at the India International Centre, New Delhi on April 21.

Rajgopal Joins Maharashtra Electronics

Mr S. Rajgopal has relinquished charge of the post of development commissioner, Santacruz Electronics Export Processing Zone (SEEPZ) and joined the Maharashtra Electronics Ltd as its managing director. A regular incumbent in his place at SEEPZ is yet to be named, but in the meanwhile Mr N.K. Bharadwaj, executive director of the Trade Development Authority is looking after the work of the development commissioner, SEEPZ.

Metallic Contact Indicator Developed by IIP

The Indian Institute of Petroleum (IIP), Dehra Dun, has designed and developed a metallic contact indicator which basically estimates and indicates the failure of lubricant film by the onset of metal-to-metal contact.

The device has been extensively used for lubricant evaluation in ball-disc machine. Whenever the stable oil film between the rotating disc and the ball under particular load breaks, a contact takes place between the ball and the disc. The contact is of random nature, and over a period, its effect is felt in the form of wear of ball and disc.

From the circuit point of view, the instrument uses a two-arm resistance bridge, sensitive fast comparator, square wave generator, gate and integrator. The two-arm resistance bridge operates on a stable DC potential, the oil film resistance being one of the arms. The comparator swings to either positive or negative voltage side depending upon whether there is a contact between the ball and the disc. The square pulses are allowed to go through the gate only if there is a metal-to-metal contact. The integrator accepts these square pulses and integrates them over the desired period. The output of the integrator directly indicates the percentage metal contact duration, 100% being defined as a condition when lubricant films do not separate the surface.

AREA Puts Forth Suggestions

All India Radio Electronics Association, popularly known as AREA, has completed 41 years of its service to trade and industry. Through its central office at Bombay and regional offices at Calcutta, Madras, Bombay and New Delhi, it works as a promoter of the electronics trade and industry, but without ignoring the interests of the consumer who is always a king (or is it a queen?).

Since 1960, AREA has held national conventions at Bangalore, Srinagar, Bombay, Madras and New Delhi. Its sixth convention was once again held at New Delhi from 13th to 15th March, 1978. It was inaugurated by Mr B.D. Jatti, Vice - President of India. The convention was made extremely fruitful by a seminar which was extended over seven sessions and which discussed a wide variety of subjects. A galaxy of central ministers such as Mr Mohan Dharia, Mr L.K. Advani, Mr Satish Agarwal, Mr Mohd. Arif and Prof. Sher Singh participated in the deliberations of the seminar. Mr H.K.L. Arora, secretary, Convention Steering Committee, was the moving force behind the convention.

While AREA is committed to the co-existence of the small - scale sector, the organised sector and the public sector, it carries on a crusade against high taxation which affects all sectors equally. Again, it has waged all these years a war—an unsuccessful one so far—for the abolition of the radio licence fee; there is no doubt that ulitmately it will succeed in this effort.

The most popular programme of the AIR is Vividh Bharti; but only 15 per cent of the population can tune in to it in different cities of the country. AREA has been urging the government to extend its coverage of the population so as to increase the size of the radio market.

There were many other interesting suggestions put forward at the seminar. Since both the ministers and the bureaucrats were invited to the seminar, it served the purpose of carrying the message of the industry and trade to the policy-makers.

And Abroad ...

'Radiocommunications' Chosen as Theme of World Telecommunication Day 1978

This year the theme of World Telecommunication Day is 'Radiocommunications.' The theme was chosen to mark the 50th anniversary of the ITU's International Radio Consultative Committee (CCIR) which is responsible for establishing international standards in radiocommunications.

World Telecommunication Day is celebrated every year on 17 May by the 154 member countries of the ITU. The date of 17 May was chosen because it is the anniversary of the signing of the first International Telegraphic Convention in Paris in 1865.

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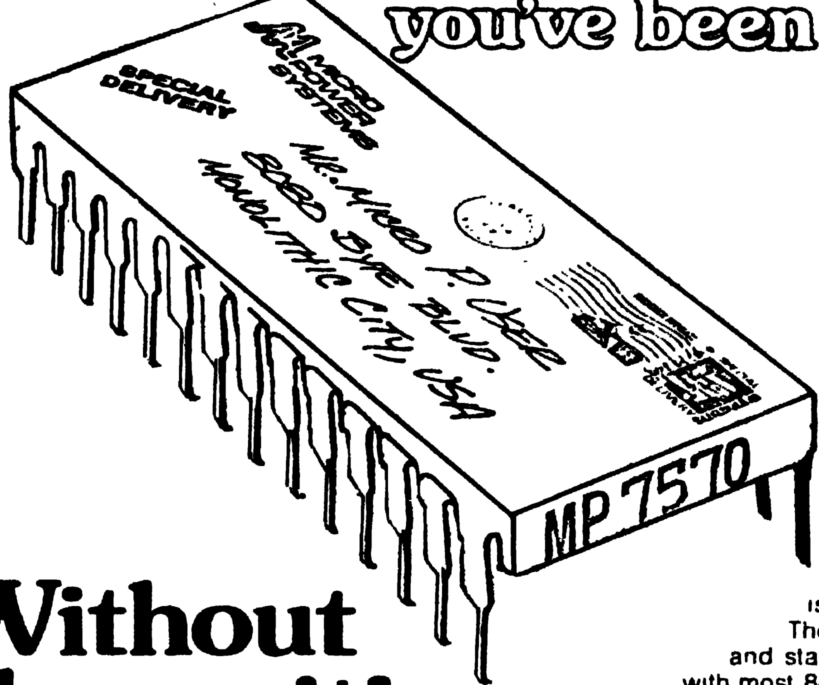

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Functionally, the 7570 is a CMOS 10-bit A/D converter on a single chip. It uses the successive approximation principle and requires only an external comparator, reference and passive clocking components. Ratiometric operation is inherent in the design, since an extremely accurate multiplying DAC is incorporated in the feedback loop. The 7570 has appropriate control inputs and status outputs for convenient interface with most 8-bit or 10-bit microprocessors.

Micro Power's proprietary High-Density CMOS is employed in producing the 7570. This low-power process features an on-chip network of thin-film resistors and silicon nitride passivation to enhance reliability and long-term stability.

Listed in the table are some of the key specs and prices for the 7570 and *related CMOS converters*. To get more information on these and other linear CMOS products, use the coupon below.

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7522 JN (D/A)	10-bits	8-bit	500nsec current settling time	$13.90
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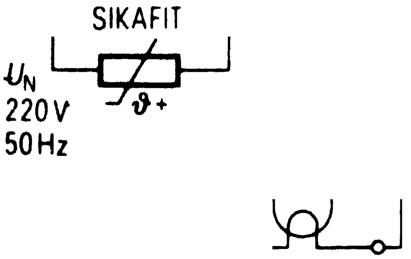
☐ Please also send data on your linear CMOS switches and multiplexers

Flicker-free Fluorescent Lamps Now Possible

The flickering that always accompanies the starting of fluorescent lamps will soon be a thing of the past: A new PTC resistor makes sure that the gas is ignited at one go, eliminating unsuccessful starts. The component, beneficial both to the lamps and to the eyes, will shortly be available under the name of "Sikafit" in an easy-to-mount, thumb-sized package.



At present, the ignition process in fluorescent lamps depends mainly on the interaction between a choke and the electrode heater, under the control of a glow starter switch with bimetallic contacts. But a constant gas discharge between the electrodes at the ends of the tube is only produced if the temperature is high enough and if the choke, in conjunction with a capacitor, has supplied an adequate voltage.

Frequently, however, the heating-up period is too short and the surge voltage too low to generate ideal conditions at once. It usually takes a few seconds for the lamp to burn steadily and for a light column to form in the glass tube. The initial cold starts with insufficiant pre-heating considerably lower the life of the tube and of the starter, and, what is more, the visual effect of a fluorescent lamp "struggling" to light up is often found very irritating. For this reason many people tend to leave fluorescent lamps on during a temporary absence, with the result that chances of cutting down electricity costs are lost.

The "Sikafit" PTC resistor produced by Siemens, W. Germany on the other hand, assures that fluorescent lamps light up without any flickering. The resistor comes in a small package with prepared leads for connection in parallel with the choke, and it prevents the choke from supplying ignition impulses for about a second. In the meantime a strong heating current flows through the electrodes in the tube. When the second has elapsed the electrodes are certain to be ready for operation. The PTC resistor has meanwhile also been heated to such a degree that the resistance decreases rapidly and the choke can ignite.

This new component can be used for 40W and 60W tubes, and if necessary also for 20W tubes. Any luminaire can easily be fitted with the resistor with the aid of a screwdriver—no special tools are required. The additional dissipation caused by the PTC resistor is approximately one watt.

Monolithic Memories and Raytheon Reach Alternate Source Agreement

Monolithic Memories, Inc., Sunnyvale, California, and Raytheon Company's Semiconductor Division, Mountain View, California, have agreed to alternate source certain of each other's proprietary bipolar LSI integrated circuit products.

Zeev Drori, president of Monolithic Memories, and F.M. Dowd, vice president of Raytheon Company and general manager of the Semiconductor Division, jointly announced the two-way agreement that initially involves three logic devices and one memory chip.

The second source pact calls for mutual exchanges of logic drawings, circuit diagrams, design tapes, certain process information, assembly and packaging procedures, and other technical and test data necessary for complete device characterisation. In addition, there will be a two-way transfer of related product and application service.

Raytheon and Monolithic Memories also agreed to conduct joint discussions on "customer programmable logic components" which could lead to future product exchanges.

The first devices to be exchanged under the agreement are Monolithic Memories' First In, First Out (FIFO) and 8 X 8 Multiplier, and Raytheon's Power-Switched PROMs (SPROMs) and Programmable Multiplexer (PMUX).

RCA Laser Beam Recorder for Space Photographs

RCA has provided NASA with a laser beam recorder which generates images from all of the U.S. space agency's satellite sensors, resulting in higher quality and faster production of photographs from space. Called the Operational Laser Beam Recorder (OLBR), it will be the primary photo production system at NASA's Goddard Space Flight Centre. The OLBR can generate images requiring up to 20,000 picture elements per line.

NASA also has installed an RCA computerised preprocessing system to enhance the quality of the Return Beam Vidicon (RBV) camera signals from Landsat satellites which photograph the earth's resources. The OLBR and the preprocessing system allow rapid production of RBV colour composite photos that are of quality previously considered unattainable, according to RCA officials.

The OLBR is completely self-contained and self-calibrated and is operated and maintained by a single operator. It controls, selects and accepts digital image data from high-density tape and transforms it into high resolution, geometrically and radiometrically correct, annotated latent images on 214mm strip film. The film then is developed and processed at Goddard to produce high resolution transparencies which are distributed to Landsat data subscribers throughout the world.

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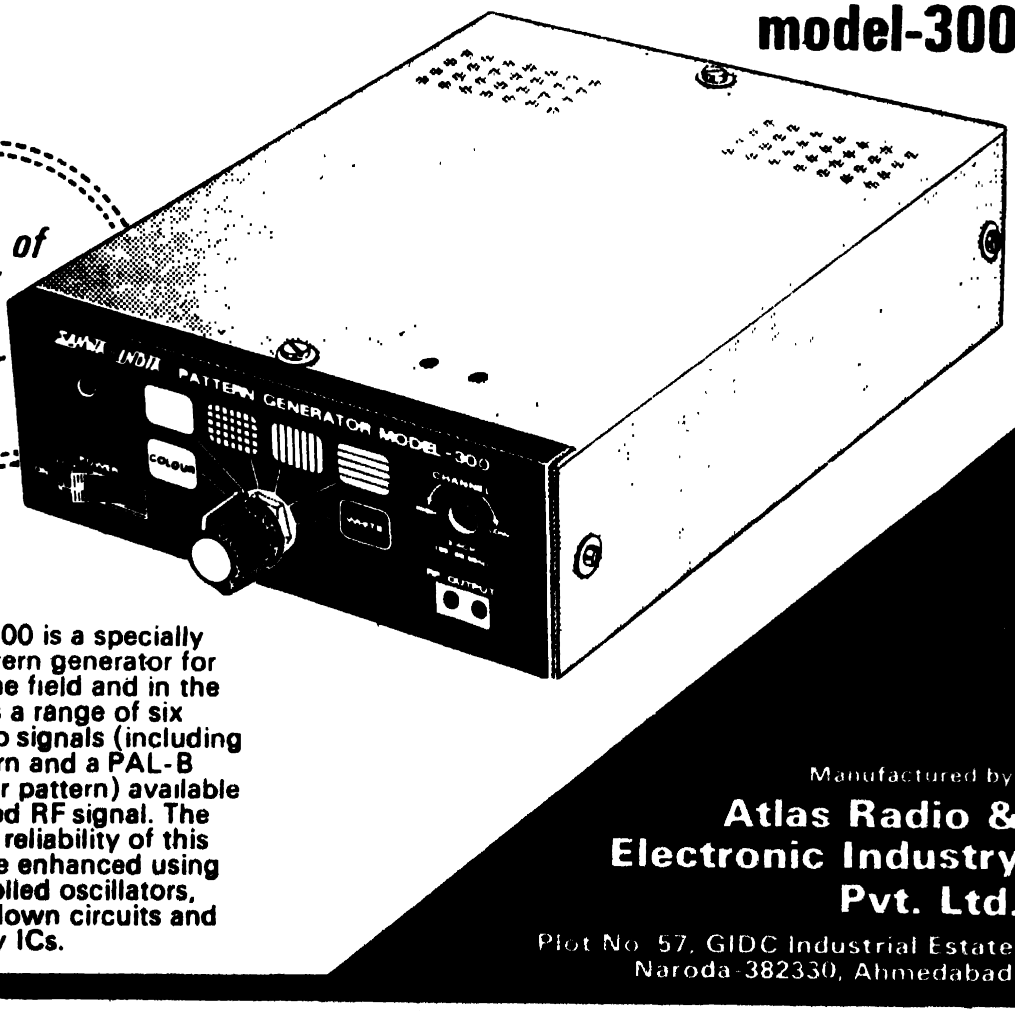

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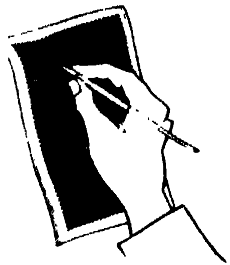


LETTERS

READERS' PAGE

The reason why I subscribe to EFY is that no other Indian magazine is so exciting and informative in the field of electronics. EFY represents creativity in electronics. But this creativity can be enhanced if you provide a page for readers to express their views about electronics.

SATISH KOUL
Haryana

Readers are welcome to express their views under this 'Letters' section for the time being.

THANKS FOR 'BROADCASTING' ARTICLE

Please convey my grateful regards to Mr Ç.V. Sulu, VU2GV whose informative article on 'Beginning of Broadcasting in India, was published in your February 1978 issue. I also thank you for your encouragement to publish such interesting articles.

MADHURANATH
Director Rashmi Enterprises
Bangalore

IMPROVE THE STEREO AMP

Mr Uday Pratap Singh of Instrumentation Ltd, Kota has pointed out a mistake in the circuit of 'Improved Stereo Amp' published in Letters column of July '77 issue of EFY.

In the circuit BC178 and PT6 should as well be connected in darlington mode. The emitter of BC 178 should be connected to base of PT6, instead of its emitter, and collector of BC178 should be connected to collector of PT6 instead of its base.

Readers who have a copy of the BEL application information Code No. AI/LIC 3, CA741, general-purpose operational amplifier may also correct Fig. 9, for low distortion power amplifier accordingly.

A. SHARMA
Bombay

NEGATIVE RESISTANCE TUNNEL DIODES

Kindly refer to the article 'Gunn Diode and its Applications' by K. Kalidas published in the January 1978 issue of EFY. I beg to state that tunnel diodes made of germanium do have negative resistance characteristics, as per 'Transistor Circuit Analysis and Design' by F.C. Fitcher (page 52).

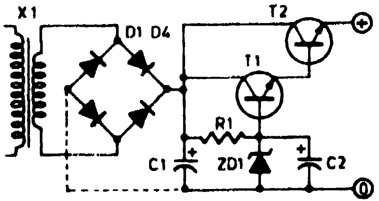
R. RANGASWAMY
Gauhati

PLEASE CORRECT

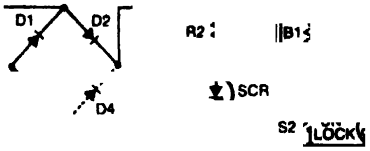
The Annual Number 1978 is very helpful, particularly due to the Directory and Buyers' Guide sections.

I have, however, noticed some mistakes:

1. In the article on 'Guitar Practice Oscillator' by P.K. Sood, the bridge rectifier has not been properly connected in Fig. 2 (page 76). The connection, now shown as a dotted line, which is essential for the circuit to work, has not been shown in the original diagram.



2. Again, in the Intruder Alarm article by D. Venkatasubbiah (page 79), diode D4 in rectifier bridge has been shown connected in the opposite direction. The diode should be connected as shown here.



3. In the TV Games article by Ajmer Singh, it is claimed that 'For those who might like to construct a TV game device, all the necessary information is being given.' But the value of Vcc—the voltage to be supplied to the circuit is not mentioned anywhere.

R.K. KAKKAD
Rajkot

EFY is grateful to Mr Kakkad

In Mr Venkatasubbiah's article the 'lock' and 'unlock' positions in the diagram were also interchanged, by mistake.

In Mr Ajmer Singh's article, the circuit shown in Figs. 1 and 2 would work on a Vcc of + 6V.

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MORE ABOUT GUITAR AMPLIFIERS AND THEIR SPECIAL EFFECTS

A.S. Sharma

Wide interest in guitar music is obviously due to the ease with which one can be initiated into its mystries. It does not need the discipline or the hard work expected of a pianist. Besides, there is a lot of scope for experimentation.

Earlier (EFY Oct. '77, pp 23-26) we saw something of the circuitry of a guitar amplifier: the preamplifier, power amplifier, reverb section along with tremolo and the power supply section. Now we would see the amplifier as a whole and some alternate circuits of reverb and tremolo.

Politics is called an art of the possible. In India we consider it as an art of the impossible. The same applies to technical matters also, as we must try to make the best of what is available and learn to live within the limitations.

The electric guitar pick-up consists of a magnet with one pole towards and one pole away from the strings. Around this magnet a coil is wound. Some guitars utilise a single magnet and coil for all strings while others use separate magnets for each string or a group of strings.

The vertical component of the string vibration varies the length of the airpath for the flux and therefore varies the flux density. This varying magnetic flux passing through a coil of wire produces an output voltage representative of the string motion. Steel wires must be used for electronic guitars since the strings are to influence the magnetic flux.

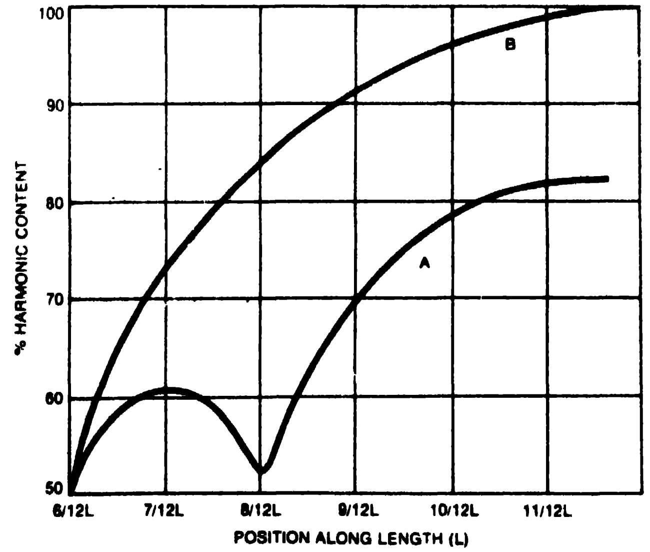

Fig. 1: Harmonic content for various positions of the pick-up; curve 'A' when the fundamental and second and third harmonics are excited equally, and curve 'B' for a fundamental with infiite harmonics.

The string motion varies along its length. At the ends, where it is clamped, there is no motion. The greatest motion is at the centre. The vibratory motion has a fundamental frequency and its harmonics. The extent of harmonics very much depends on the point of initial plucking. In an electronic guitar only that part of the string which is above the pick-up has its motion reproduced as sound. All harmonics and transients present at the pick - up can be converted to electrical output, if desired. Tone of the pick-up can be varied by positioning the pick-up. Curves in Fig. 1 show the harmonic content of the pick-up for various positions. Curve A shows the harmonic content when the fundamental and second and third harmonics are excited equally. Curve B is for a fundamental with infinite harmonics.

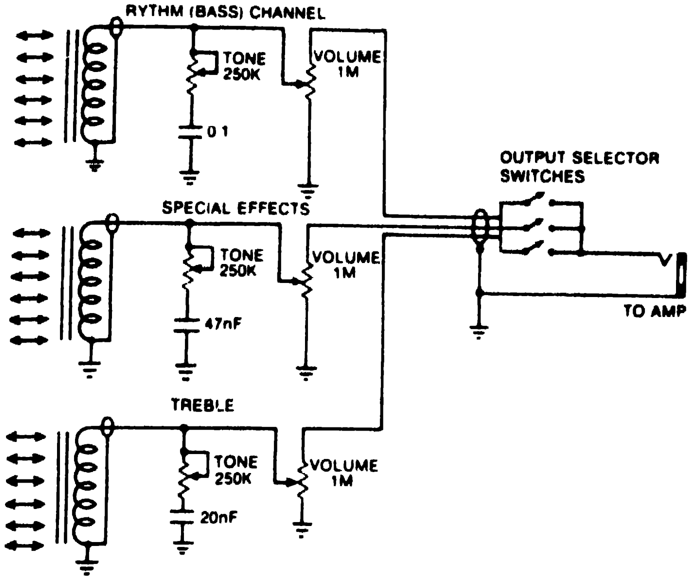

Fig. 2: A three pick-up arrangement for a guitar.

If the pick-up is near the centre of the string, it will produce more of the fundamental and lower harmonics, resulting in a mellow sound. If it is placed near one end of the string, it will pick-up more of the upper harmonics and result in a sharper sound. Fig. .2 shows a three pick-up arrangement for a guitar. The pick-up placement decides the content of the signal which is accentuated by adjustment of the tone control. The volume control is adjusted to match the sensitivity of the amplifier. The desired signal can be chosen by the output selector switch.

Normally each channel of the guitar amplifier allows two inputs to be fed in, normal and bright (with treble accentuated). The mixed signal is amplified. Fig. 3 shows the block schematic of the amplifier using the circuits discussed in Oct '77 issue of EFY. The guitar amplifier should have at least two input channels, one for straight amplification of normal signal and the second for special effects such as reverb and tremolo.

A third channel is provided for microphone input. In case the dynamic microphone has sensitivity and input signal comparable with that of the guitar, the microphone channel may use the same pre - amplifier circuit. As the guitar channels as well as the microphone have low input signal, it is essential to ensure that the input cable is properly shielded to eliminate hum pick-up.

As indicated in Fig. 2, each pre - amplifier channel has its own volume control and bass-treble tone control. If desired, a master volume control may be introduced at the input of the power amplifier. Series resistors in the output of the pre - amplifiers allow proper mixing of the output signal. In the case of special effects channel, part of the output signal is fed to the reverb unit, the output of which is fed back to the input of power amplifier at point A in Fig. 3. At this point the light dependent resistor (LDR) of the tremolo section is also connected. It is obvious that the variation in the resistance of the LDR would affect the signal passing on to the input of power amplifier from the special effects channel. Reverb and tremolo effects are not always used; they are controlled by the operation of a foot switch. Depending on the effect desired, the special effects signal may be processed through reverb or tremolo alone or through both reverb and tremolo together.

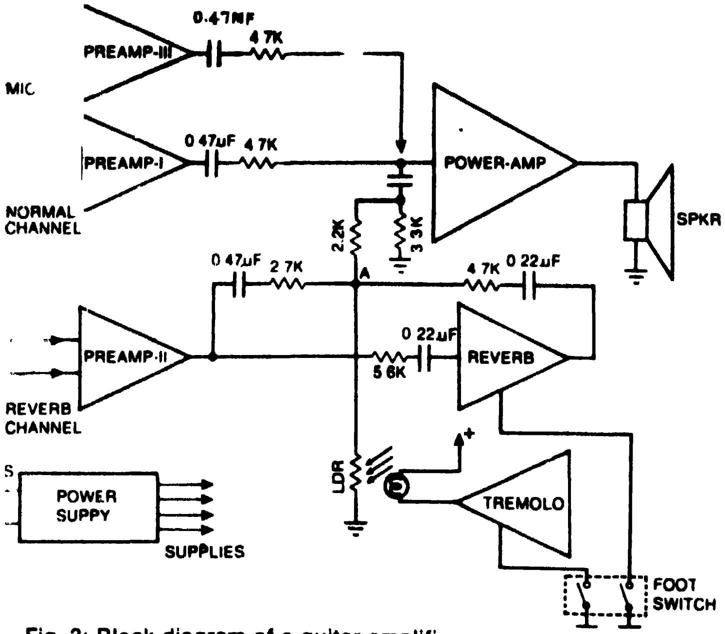

Fig. 3· Block diagram of a guitar amplifier

The reverb section described earlier was high impedance type. As such it was directly coupled to the collector of the transistor. The electromechanical units are available with low input impedance as well with the input voltage requirement of over one volt. An alternate arrangement shown in Fig. 4 uses a low impedance unit of 8 ohm or so; the input amplifier is therefore followed by a power amplifier. The power requirement is not particularly high. A direct coupled four - transistor circuit with AC187/AC188 as complementary output pair operating on 6- or 9-volt power supply would provide adequate output.

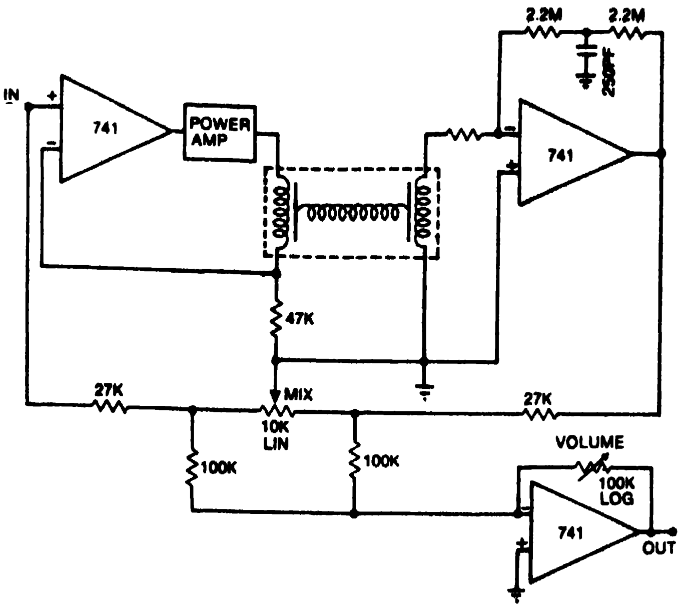

Fig. 4: An alternate arrangement using a low impedance unit of 8 ohm or so.

The magnetic flux produced in the input coil of reverb unit induces vibrations in the permanent magnet core suspended in the magnetic circuit. The vibrations are conveyed to the output unit through a spring, resulting in a delay in time. The output unit has a high impedance and a similar magnetic circuit. The spring coil at the end is attached to permanent magnet core placed in the magnetic circuit of the output coil. The vibrations of the permanent magnet in the magnetic circuit of the output coil produce electrical signals in the coil of the same order as the guitar signal, i.e. around 2 to 5 mV. Normally part of the vibrations would be reflected back and forth until they die down, thus producing a more realistic effect. Professional delay lines can be fairly long, 45.7 cm or so. For hobbyists, smaller units, 10 cm to 15 cm in length, are available.

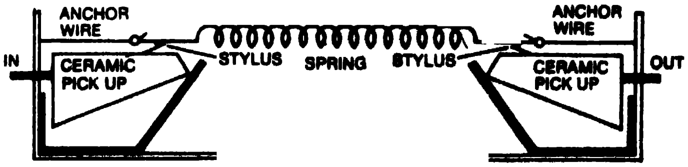

Fig. 5: An arrangement in which electromechanical units use ceramic pick-ups instead of magnetic coils.

Because of the characteristics of the electromechanical units, treble response is not good and a certain amount of treble boost in the output becomes necessary. The output from the unit is amplified with treble boost and mixed with the input signal. The mixing arrangement used crossfades from dry to fully reverberated by shorting out what is not needed. The mixed output is amplified; gain of the output amplifier is controlled by variable resistance in feedback circuit. In case 741 ICs are used, the minimum supply required would be 12 volts, preferably higher. Two - transistor direct-coupled circuit commonly used as a preamplifier in amplifier/tape recorder circuits would normally be adequate.

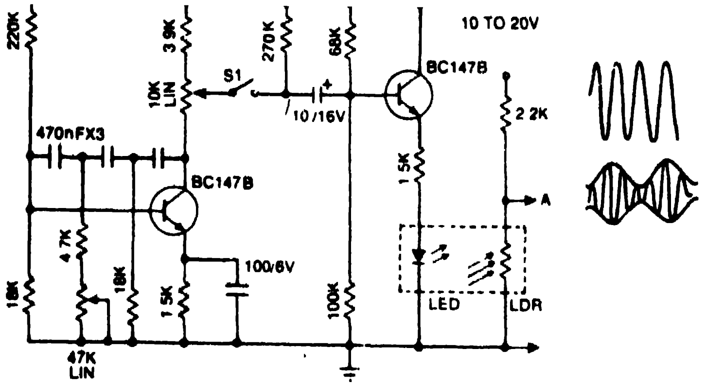

Fig. 6: An alternate circuit with LED-LDR combination in the emitter of the output transistor.

Hobbyists may also like the arrangement shown in Fig. 5. Here the electromechanical units use ceramic pick-ups instead of magnetic coils. The signal applied to the pick-up at the input end induces vibrations in the stylus, resulting in vibrations of the spring. These vibrations travel to the other end of the spring and induce vibrations in the stylus, resulting in an output signal which is a small fraction of the input signal.

An average pick-up with an output signal from 250 to 1000 mV can be used for the purpose. Proper care is very essential in the assembly of the spring coil. The spring should be so tensioned that there is hardly any permanent loading of the stylus which can restrict its freedom of movement and result in distortion of the signal. Input pick-up can be directly coupled to a small-signal amplifier with a voltage output of about a volt. At the output we would need an amplifier on the same lines as the magnetic unit. Additional care would however be essential here to prevent hum pick-up as it is a high impedance circuit. It would be better if the complete assembly is floated on springs to isolate it from stray vibrations.

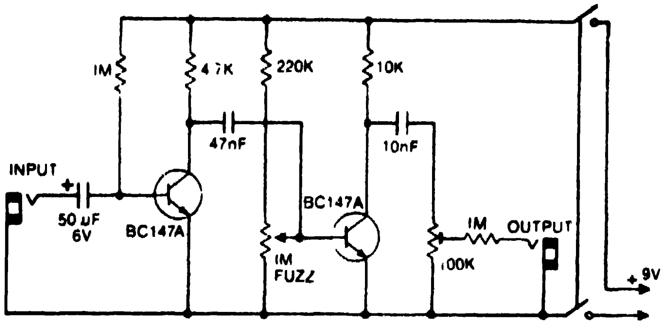

Fig. 7: Circuit for 'fuzz' effect.

The lamps required for the tremolo unit should be rated around 10 mA, 4.5 V. In case suitable lamps are not available, it may be necessary to use LEDs in series with a suitable resistor to ensure that the peak current does not exceed 10 mA or so.

An alternate circuit is shown in Fig. 6 which operates on similar lines with the LED-LDR combination in the emitter of the output transistor. Rate of tremolo effect and the depth can be varied in the same fashion. However it must be noted that the depth control varies the amplitude of the output signal. The depth of tremolo effect would very much depend on the variation of resistance of the LDR used. An imported LDR unit ORP12 or the indigenous unit EIP-274 manufactured by Electron India may be used. Opto-couplers used in control circuits as LED-LDR assemblies can also be used. It is essential that the LDR is closely coupled with the LED and shielded from stray light.

Reverb and tremolo effects are sometimes used for microphone signal as well. An identical circuitry can be used for the microphone channel also. Reverb would add a concert hall effect to the voice, softening it to some extent and adding a slight boom to it. The addition of tremolo gives a heavy breathing effect and, together with reverb, an echo effect with proper adjustment of tremolo speed.

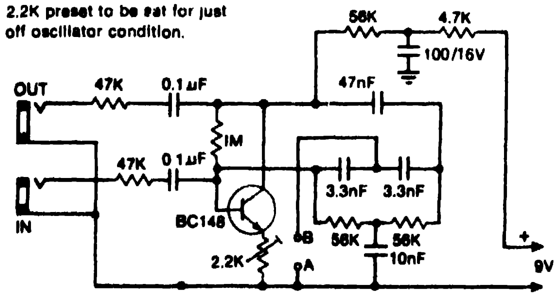

Fig. 8(a): Cuircuit for 'waa-waa' effect.

In additon to these effects, fuzz and waa-waa effects are also commonly used with guitar. The circuit for the fuzz effect is shown in Fig. 7. It is basically a two-stage transistor amplifier. The input is first amplified by T1 and then passed to the base of T2. This second stage acts as an overdriven amplifier which clips and distorts the signal, producing the fuzz effect.

The bias on the base of T2 can be adjusted by means of the potentiometer VR1. This changes the nature of the distortion and provides a certain amount of control over the quality of the fuzz. The preset VR2 is incorporated to act as a variable attenuator so as to prevent overloading of the main amplifier. The values of the capacitors C2 and C3 have been chosen so as to provide a certain amount of the treble boost which is a desirable effect with the fuzz sound.

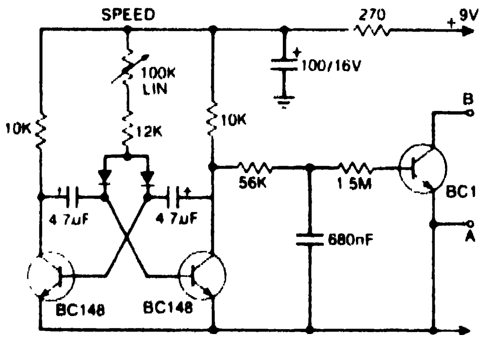

Fig. 8(b) A typical circuit for 'auto-waa

If more treble boost is desired, the values of C2 and C3 may be reduced further.

The waa-waa effect is obtained with a band-pass filter whose centre frequency is varied up and down a portion of the audio spectrum, approx. 200 Hz to 300 Hz. This is supposed to simulate the operation of the mouth when pronouncing the sound waa-waa. The mouth cavity forms a resonator whose centre frequency is controlled by the actual volume of the cavity, and this in turn is controlled by the position of the lips and gums. The electronic simulation is done by a band-pass filter whose resonant frequency is controlled by a potentiometer, usually linked mechanically to some sort of a pedal assembly. The filter takes the form of a band-stop circuit in the feedback loop of an amplifier. This produces the band-pass function required to achieve the waa-waa effect. Fig. 8(a) shows such an arrangement where a variable resistor is inserted between points A and B.

The sweeping can be controlled by another circuit to get auto-waa. A typical circuit is shown in Fig. 8(b). Here a transistor replaces the variable resistor. Use of transistor introduces non-linearity; the harmonics generated however tend to add to the general waa-waa effect. Waa-waa is often combined with fuzz, which provides more harmonics for it to work on.

These are only some of the electronic effects that can be used with a guitar to modify the natural sound of the guitar. In effect a vast horizon is open to guitar players once the limitations as well as the additional variations that are possible are clearly understood. To get the best from the guitar, of course, it is essential that the basic fundamentals of music are understood.-Knowledge of music helps to manipulate the variables for the best effect. ☐

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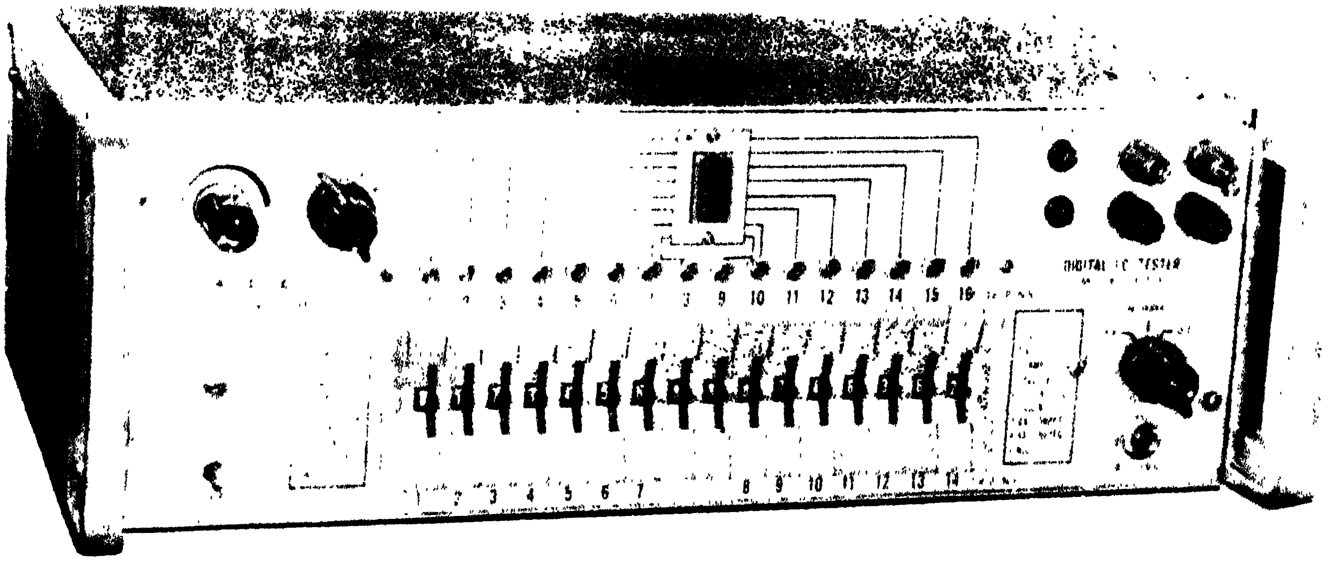

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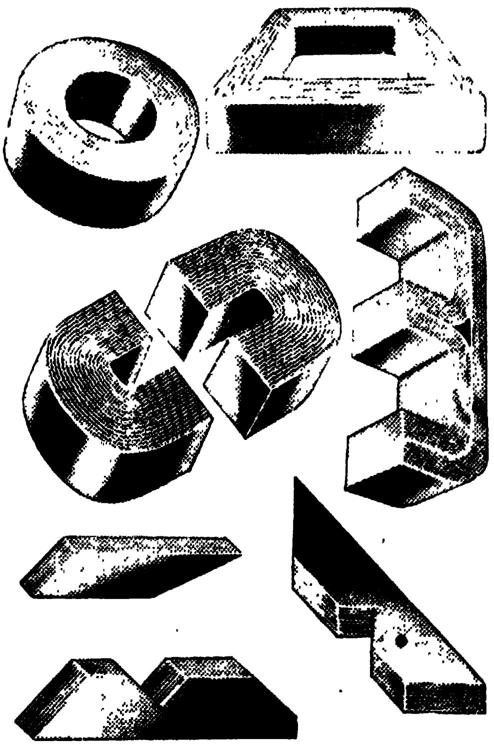

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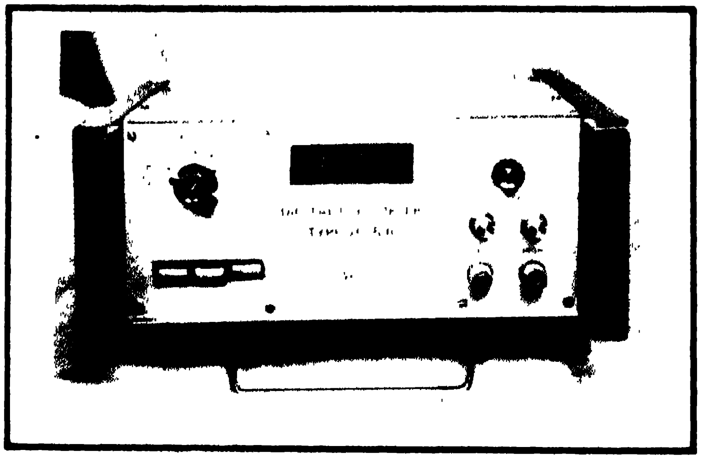

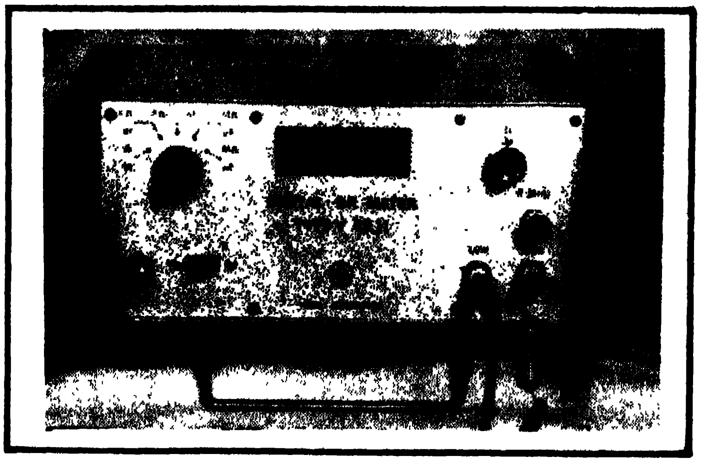

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DIGITAL INSTRUMENTS

Impact of Large Scale Integration on the DMM & DPM

K. Doraiswamy

Without a doubt, the digital voltmeter and the digital multimeter, as we know them today, would not exist but for the development of the integrated circuit. The idea of a meter that provides an easy-to-read digital rather than analogue display is not new—the digital voltmeter is 25 years old. However, truly practical, reasonably-priced DPMs had to await the 1960's for the advent of reliable digital and linear integrated circuits.

The impact of ICs on DPMs/DMMs has been no different than their impact on other types of test and measuring instruments. In fact, the rapid development of DPM/DMM technology paralleled the rapid technological developments of the electronics industry in general.

The many advantages of using ICs, particularly LSI devices, in DPMs/DMMs are well known—greater accuracy, smaller and more rugged meters, more instrument functions on the same chip, lower component count, higher reliability and, in many instances, more meter functions. LSI and the microprocessor have made "smart" meters possible.

DPMs and DMMs are now being used instead of analogue meters in ever increasing numbers in general-purpose industrial and in research and development applications. They offer greater speed, higher accuracy and resolution, and automatic measurement. As a result, these meters can be designed for work situations in generalised applications areas, from field service to advanced research.

IC technology has made available hand-held portable DMMs costing as little as Rs 2000. Some DPMs are now capable of calibrating and troubleshooting themselves, massaging numbers, and interfacing with other instruments in a system. While the hand-held digital portables often compete with traditional analogue voltmeters and VOMs, nothing in the analogue meter world competes with the bench and systems DPM/DMM. Rupee for rupee, no analogue meter possesses the functions or has the accuracy and resolution of the digital meter, and none has the "smartness" that many digitals have.

ICs do it all

Where are the Ics used? Just about everywhere—in A/D conversion, control logic, decoders and in drivers for readouts. Some are dedicated LSIs, particularly in low-cost meters. The N-channel MOS device contains all of the control logic circuits as well as some of the analogue switches for a low-cost DPM. For a dedicated LSI to be used in a low-cost device, though, the volume of production must be high enough to amortise the development cost of the custom chip.

In some cases, passive as well as active circuit elements are integrated in a small package For example, an IC chip containing the equivalent of 20 discrete wirewound resistors is just 200 mils square and contains resistors as large as 10 megohms with ratio accuracies within 0.005%, and with ability to handle up to 1000 volts.

Many semiconductor manufacturers produce ICs designed specifically for DPM/DMM and similar applications; for example the Intersil single chip 3½-digit CMOS A/D converter. Siliconix also produces single and double A/D chips for the same application. Some other A/D converters with higher digit counts are also available. There are off-the-shelf decoders and drivers for all types of readouts: LED, LCD and gas discharge. Whether dedicated or off-the-shelf ICs are used, a typical low-cost DPM/DMM usually contains from two to six ICs. The total parts count, because of the extensive use of ICs, is often as low as 80 to 150 parts, depending on the meter's functions.

The use of custom LSI in the more expensive general-purpose, bench and systems DPMs/DMMs is more limited because of the generally lower volume of sales. Because of their extensive use of standard LSI circuits, these meters provide an excellent performance/ price ratio, particularly the smart ones. Besides the many measurement functions they perform, including number massaging, they can also perform extensive self-test and self diagnostics. This results in considerable improvements in serviceability and in servicing costs as well.

Of significant importance is the ability of these smart instruments to perform automated measurements, anywhere from the R&D lab to the production floor. In the past, the cost of this function was prohibitive, but the use of LSI has reduced the costs dramatically

Generally, microprocessor-based DVMs/DMMs take two broad approaches. In the first, the microprocessor handles all the control functions, including the meter's self-calibration and self-diagnostic features. With the second approach, the microprocessor handles the system's interface functions and ignores the control functions. More recently, however, microprocessor-based systems have been incorporating both the functions. Besides they have incorporated the ability to combine computational and complex algorithmic control along with the conventional measurement functions

Mr K Doraiswamy is products manager in Zenith Electro-Systems Pvt Ltd, Bombay

Over the past five years or so, there have been rapid technological advances in the DPM and DMM field, culminating into a smart meter. In the next few years, though, it appears that advances will be more mundane. Many of the developments will simply be improvements on the present generation of DPMs and DMMs. For example, one of the improvements will be in reliability.

What's in the future?

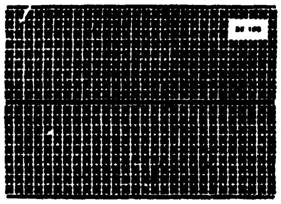
More and more meters in the very low-cost range will incorporate true rms readings. And, particularly in the low cost range, you will probably see smaller and lighter meters, more burnout protection, four-terminal ohmmeter systems and two levels of ohmmeter power. Undoubtedly, hold buttons will retain a display reading.

During the next few years, bench and system oriented meters, particularly the smart ones, will not change dramatically from those we have now, although more smart meters will probably appear on the market. One important feature they are likely to offer is higher conversion rate, which will reduce testing time.

DVM and DMM accuracy should not change dramatically over what is available today. In fact, some users feel that meter designers have an obsession with accuracy and that, with very few exceptions, today's DVMs and DMMs meet their requirements. A number of people, including manufacturers, think reliability limitations will tend to restrain breakthrough-type advances in DPM and DMM design over the next couple of years.

What about costs? Which way will they go? For low-cost, general-purpose meters there is a good chance the prices will go down Many manufacturers believe that the under Rs 1000 DMM will be common in a few years. There is a high degree of incentive for such a low-priced DMM to compete with the standard VOMs still dominating the market.

And what about bench and systems DVMs and DMMs? Here, prices can go either way. Better LSIs can reduce costs, or at least keep them stable. Or better LSIs might provide more functions or improve maintenance, ease of use, and reliability. In the latter case costs will no doubt increase, but with a much improved performance/cost ratio. Except for low-cost, portable DMMs the possibility of a significant performance improvement at significantly reduced costs is not too probable.



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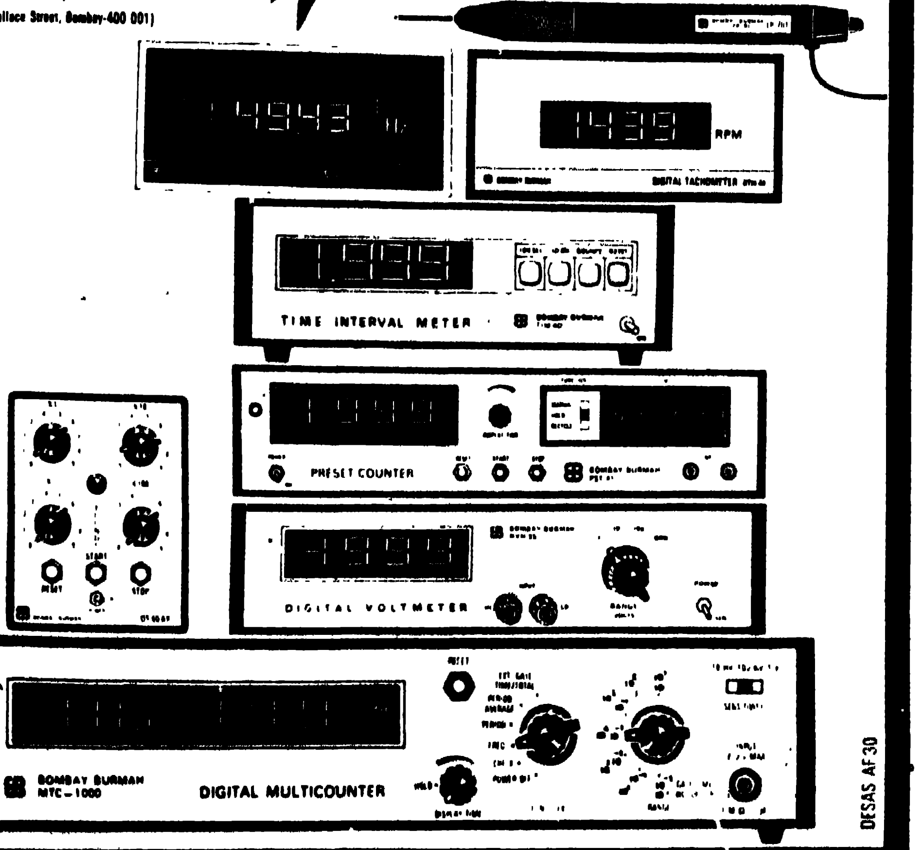

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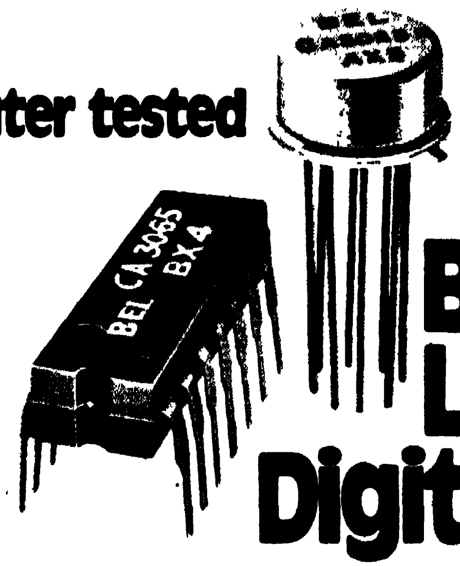

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Look Before You Buy Digital Instruments

V. Ramesh Venugopal

Look at the digital instrument specifications more closely — you are bound to unearth a lot of bugs!

Digital instruments and digital output devices are in the nascent stage of development in our country. Over the last few years, several small and large manufacturers have mushroomed into this field offering the user and the original equipment manufacturer a wide and competitive range to choose from. However, when one looks carefully into the specifications sheet, one will find most of the important specifications which define the long-term performance, reliability and repeatability of the digital device to be missing. A closer examination of the device could reveal several specification-bugs which either the manufacturer has carefully excluded from the data sheet or is totally ignorant of himself.

Selecting a digital instrument or a digital output device could be very difficult due to the lack of standardisation of specifications in this industry. Even though most of the specifications are easy to understand, misinterpretation could result due to the varying methods used to specify the performance parameters in the data sheets. For example, the accuracy of the digital device which is meaningful only when stated along with other conditions such as the temperature range and time period over which this accuracy holds, is hardly found in any specifications sheet Apart from this, accuracy being defined in terms of the legal' volt, the manufacturer must maintain calibration standards traceable to this standard.

Secondly, the manufacturer may not have the necessary calibration facilities or a calibration laboratory equipped with instruments and devices that can be used to countercheck the accuracy of the specified order. This is especially true in our country where several digital instrument manufacturers are only involved in obtaining kit-parts from abroad, and packaging them together to form a full-fledged instrument. The meaningful way to specify accuracy would be to include the temperature, line variations, and humidity conditions, under which the accuracy holds. For example: ± 0.1% of rading, ± 1 digit, at 30°C, ± 5°C for 30 days at 50% rh., 10% line variation.

Another specification that most manufacturers of digital instrument fail to specify is the short-term and long-term stability of the device. A short-term stability which is usually specified for a 24-hour period, and for a ± 5°C difference in temperature, may prove to be the real specification-bug in the instrument. Components used for digital instruments and devices are temperature sensitive, and poor location of components, like transformers, which generate heat, could cause steep temperature gradients and deteriorate the accuracy and stability of the instrument far beyond what one can imagine. The short-term stability tells the user how good the device is for relative measurements within the day, and is more or less the effective sensitivity of the device.

Yet another specification which could be the hornet's nest to the end-user is the temperature coefficient which is very cleverly hidden among several other specifications. Errors calculated using the temperature coefficient are additive to the basic accuracy. The end-user must know the temperature over which the device is designed to operate, and the extent of degradation in the vital specifications at the edges of this temperature range.

Mr V. Ramesh Venugopal, 28, did B.Sc. (Hons) in physics and M.Sc. (Electronics) from Central College, Bangalore University. Since 1974 he has been involved in extending application support in the fields of analytical, medical and other electronic instrumentation. At present he is employed as an assistant manager in the marketing group of BPL-India Pvt Ltd, Bangalore.

In several other applications, the speed of response of the digital device could also be a very important consideration. Settling time is rarely given on a data sheet and even this may not be really indicative of the speed with which meaningful readings can be taken. The response time of a digital device could be considerably changed due to input filtering and auto-ranging facilities, and end-users should insist on the details. The use of certain filters and other rejection circuits at the input could cause charge-accumulation, resulting in a kick-back to the device being measured.

Most modern digital instruments use FET inputs which have very high input impedance. However, the magnitude of the leakage current is a very important specification, which generally digital instrument and device manufacturers seldom reveal. Even when the manufacturer specifies the input impedance and bias current values, the change in any specification with temperature is never known.

When measuring sources that are purely resistive, the shunt capacitance may combine with source reactance to effect linearity or bandwidth of the converter.

Common mode rejection ratio, which is also a rarely specified parameter, is never generally checked at the production stage by most small manufacturers due to lack of facilities In certain applications the ultimate utilisation of the digital instrument or the device could depend on this single parameter.

A wide range of indicating devices in the form of LEDs and LCDs have invaded the market. However, the true specifications of the display device such as its MTBF, light output, current drain, visibility, reliability, temperature stability, long and short-term reliability are hardly known.

In their effort to produce a compact and sleek looking digital instrument or device the manufacturer may entirely overlook the layout and design features which could cause considerable heat generation within the instrument after a certain period of use, making the readings and the specified accuracies entirely frivolous The best way to counter these possibilities is to open up the instrument and physically examine the location of the components such as transformers for their location in the instrument

Whereas the output device could be used to measure a process parameter, the manufacturer of the digital output device, for example DPM, may be specifying the accuracy of the basic DVM which could prove to be meaningless in the ultimate analysis.

Serviceability, which is another important consideration is hardly highlighted by the manufacturer. The integrated circuit and the other components may have been soldered directly to the printed circuit card, making servicing a very tedious and time-consuming task. Most manufacturers eliminate IC sockets in their efforts to reduce costs. Further, the cost of connectors and their poor availability force several manufacturers to directly solder-link printed circuit boards to display boards, which could prove to be very irksome while servicing the instrument.

Back in the mid-sixties transistors were available from a dozen manufacturers at throw-away prices, inspite of which leading manufacturers were continuing to sell equivalent transistors at premium prices. Similarly, a hoard of display devices are now available, ranging in their prices from a few cents to fractions of a dollar. In order to lower their prices, manufacturers tend to use the cheapest indicating devices available in the market, paying little or no attention to their reliability, stability, or luminous output.

It would always be worthwhile to visit the manufacturer's site and have an elaborate look at the calibration and test facilities he has and the methods of inspection and quality assurance programmes that are employed.

Two central questions that many design engineers, manufacturers and end-users ask are: "Should I go for analogue or digital?", "Should I buy a digital output device on OEM basis or develop it in-house?"

The answer to the first question is to find out whether the four significant advantages of digital electronics are indeed required in the application. The advantages are extremely good resolution/ accuracy, easy readability, fast measurement speeds and interfaceability with a wide range of I/O devices. If these are not *truly* essential, the use of a digital indicating device becomes just a fancy and in several cases will prove more expensive to maintain and the possible reason for failures—ultimately becoming the sore spot of the whole equipment. If the application can be met by analogue indicating devices, one should choose them as they have less bugs in them and are very inexpensive initially as well as in the long run.

To answer the second question it would be worthwhile evaluating the in-house capability and expertise in digital electronics before deciding on an OEM purchase. Chances are that in-house engineers are as good and sometimes better than most small time digital equipment manufacturers.

Hence in the ultimate analysis: There is an immediate need for setting up performance standards and specification standards that a manufacturer should specify, and the facilities he should possess before he qualifies for manufacturing these devices. The ISI or any other competant body will do good to set up a committee to look into the quality assurance of digital instruments and other digital output devices in order to prevent spurious and ignorant wayfarers to enter the field of digital electronics. ☐

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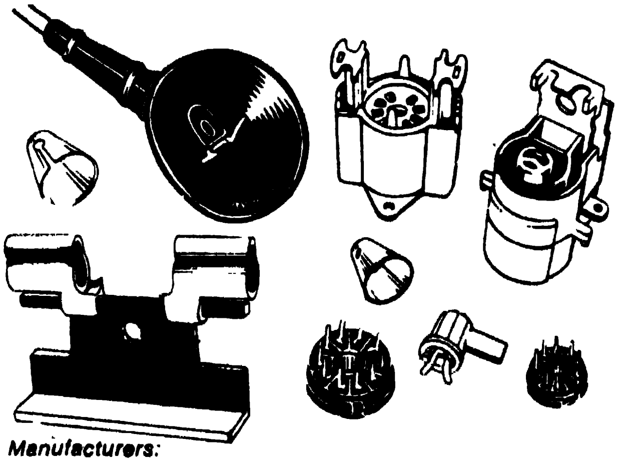

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ACCURACY OF DIGITAL VOLTMETERS

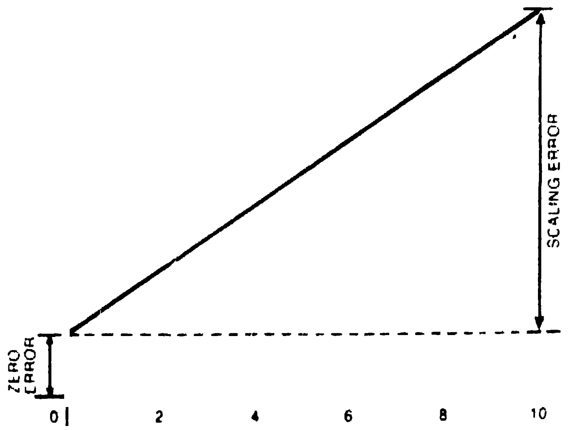
K. Kalidas

The digital voltmeters are extensively used as standard test instruments in the engineering laboratory and also as components in automated instrumentation systems. Often the exact conditions under which measurements will be performed are unknown at the time of instrument purchase. The user generally prefers an instrument whose performance is relatively independent of environment and has a good degree of accuracy over the range of applications. But the user must know two factors; the accuracy of the instrument he needs, (a highly accurate instrument can mean an unnecessary expense when it is only intended for use in a system of lower accuracy) and what the manufacturer means by accuracy of the instrument for his range of applications.

Here an attempt is being made to describe how precisely the accuracy of a digital voltmeter (DVM) can be specified by the manufacturers, and evaluate the sensitivity, resolution and various other sources of errors that can affect the measurements. A discussion on the selection of an instrument for a given measuring application is also presented

Accuracy specification of a DVM

The accuracy statement of a DVM defines the limit of error within which a digital voltmeter will indicate the values of the parameter being measured. It is normally assumed that the error is specified with respect to a standard volt.



Gig. 1: **The error of a reading over a single range of readings of a DVM.**

The accuracy specifications are usually expressed in two parts: a percentage of reading error and a percentage of full scale error. This is because some sources of error are fixed and are independent of the input signal, while other sources vary with the magnitude of the input signal. The fixed errors expressed as a percentage of full scale error are generally related to the internal noise level, amplifier zero drifts and offset voltages arising in switches used in the DVM. The errors proportional to signal amplitude, expressed as a percentage of reading, are associated with the inaccuracies in amplifier gain, divider networks and the internal reference voltage. The effects of these two types of errors on the actual accuracy of a reading are significantly different

A typical accuracy statement for a 4½-digit (maximum reading 19999) DVM may be ± 0.05% of reading + 0.02% of range. The ± 0.02% of range in the above statement is thus equivalent to ± 4 in the last digit. At the top end of the range, the maximum error will be 0.05% of 19999±4 = 14 or 0.07%. At the lower end of the range, just before it is switched to a more sensitive range, the maximum error is 0.05% at 2000 + 4 = 5 or 0.25%.

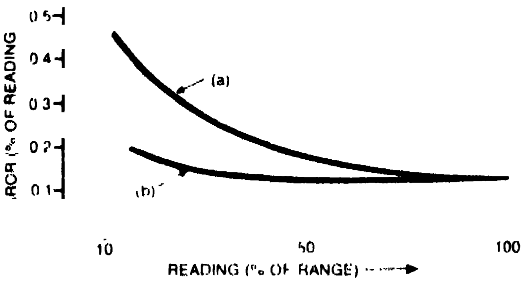


Fig. 2· **Characteristics of two DVMs having accuracy statements: (a) ± 0.05% of reading ± 0.5% of full scale, and (b) ± 0.09% of reading ± 0.01% of full scale.**

The total error of a reading over a single range of readings of a DVM is as shown in Fig. 1

Considering two DVMs having accuracy statements as: (a) ± 0.05% of reading ± 0.05% of full scale and (b) ± 0.09% of reading + 0.01% of full scale, it is evident from Fig. 2 that the two accuracy statements permit the same error at full scale, but a DVM with accuracy statement (b) is better than the other as it is two times more accurate when measuring signals at one-tenth of the full scale

Sensitivity and Resolution

A DVM which can just detect 10 mV is said to have a sensitivity of 10 mV. However if it can just distinguish between two levels 10 mV apart, for instance 19.98 and 19.99 volts, then it is said to have a resolution of 10 mV.

It is also important to note that a statement that the resolution is 10 mV does not imply that the instrument is as accurate as this. In particular, the input attenuator and range control can affect accuracy, resolution and sensitivity.

Effects of environment

The accuracy specification defined by the manufacturers generally expresses the performance of DVM under optimum conditions and within a definite period of time or check out. It is the built-in accuracy which takes into account the resolution, short-term stability of the internal reference, and precision of the resistors used as range dividers. In addition to this built-in accuracy, the accuracy of the DVM is also affected by the environmental factors such as temperature, humidity, superimposed noise, ground loops and high source resistance.

Time and temperature effects

Digital voltmeters of similar specifications will show different accuracies when they are operated over extended periods of time and range of temperatures. Every DVM requires periodic recalibration: the frequency of recalibration is determined by the accuracy required.

The manufacturer usually provides a statement defining an instrument's temperature coefficient. Like accuracy statement, the temperature coefficient statement is also given in two parts. A typical temperature coefficient statement might be ± 0.0002% of reading ± 0.0001% of range per degree centigrade The error corresponding to this statement along with the accuracy statement (± 0.004% of reading ± 0.001% of range) at 25 ± 5°C a DVM is shown in Fig. 3 for a temperature range from 0°C to ± 50°C, which is generally accepted as the standard temperature range for specifying the operation of DVMs.

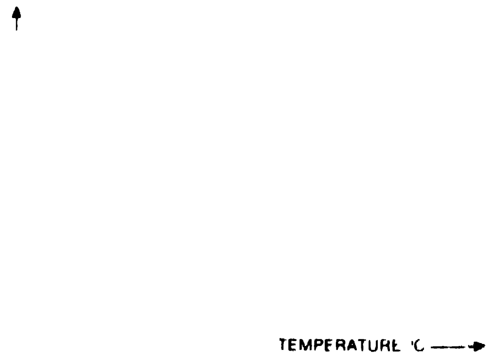


Fig. 3: Dependence of a DVM reading on temperature over the standard 0°C to 50°C range.

Effect of load errors

The load error also affects the measurement of a DVM. In order to make the full use of the accuracy of digital equipment, it is to be realised that a ratio of 1: 1000 between the source impedance and the input impedance of the voltmeter will double the error of an 0.1% instrument. Hence an input resistance of at least 10 megohm is a must for a digital voltmeter

Effect of offset current errors

The offset current in the amplifiers is an important source of error when measurements are made in high-ohmic circuits. One nano-ampere offset current produces an error of 10 in the last digit of an instrument with 10 μV resolution, when it is passed through an impedance of 100 megohms. The offset current is temperature dependent, and hence compensation must be provided to reduce this current to a low minimum value.

Mr K. Kalidas, 29, obtained B.E. degree in Electronics & Communications and M.Sc. (Engg) degree in Applied Electronics from the University of Madras in 1972 and 1974 respectively. He joined the department of electronics and telecommunication in A.C. College of Engg. & Tech., Karaikudi, Tamil Nadu in 1974 as an associate lecturer.

At present he is working as a research officer (Telecom) in the Instrumentation division of Central Water & Power Research Station, Pune, since 1976. Here he is engaged in the design & development of instruments for measuring the hydrological parameters. He is interested mainly in microwave solidstate devices and digital electronics.

He received the best project work award from the director of technical education, Tamil Nadu in 1972.

Effects of series mode errors

The series-mode signal is the AC signal present in a DC measurement output. This AC signal can be eliminated in DVM by using the integrating analogue to digital coverters. The extent to which the AC signal (series-mode signal) is rejected by an instrument is expressed in terms of the series-mode rejection ratio (SMRR), which is generally somewhere in the range between 100: 1 (40 dB) and 1000: 1 (60 dB) with respect to a specified frequency.

Effects of common-mode errors

Common-mode voltages are those voltages which appear in both sides of a signal line to a common reference point, generally the common point of earth. The common-mode rejection (CMR) is usually specified separately for DC and AC voltages.

The CMR for DC depends mainly on the insulation between the low voltage lead and the voltmeter ground. For good common-mode rejection for AC signals, the stray capacitance between the low voltage leads and the ground should be as low as possible.

Effect of thermal noise

Another source of error which is encountered mainly at the lower end of the range is due to thermal noise. The thermal noise of the input resistance gives rise to an error voltage in the AC ranges at open input. It can be calculated from:

$$V = \sqrt{R^2 - S^2}$$

where V is the voltage applied to the input, R is the reading displayed and S is the error voltage of the instrument at the same source impedance as the circuit to be measured. With the source impedances up to 10 kilohms, most AC ranges will not give more than 1% of range end value error voltage. At a reading of 10% of range this means that the error due tc noise is of the order of 0.5%.

Direct Reading Logic Probe

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G.L. Kataria

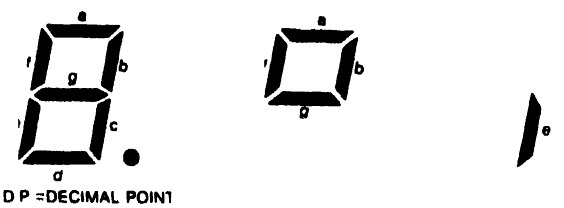
The advent of the digital electronics era in the field of electronics has made a tremendous impact. Most electronic instruments now do not have the conventional moving coil panel meters which have been replaced by the digital readouts, thus eliminating the possibility of taking wrong observations on the meter. Gradually more and more items are being converted into the digital form, and it is quite likely that the coming generations would use a lot of digital systems.

The changing concepts have brought a corresponding change in the servicing techniques also. A number of new test instruments have been developed for fault diagnosis and servicing of digital equipments. One such versatile test equipment, which I have found to be very handy and useful, is the logic probe. A logic probe is used to check the logic states in digital circuits. It can help a lot in diagnosing faulty digital circuits in which the logic states are probed and tallied with the correct or actual conditions that should have been present if the circuit was functioning properly.

This article presents details of one such probe which besides being low-cost is very compact and yet easy to assemble. An important feature of this probe is that it actually displays the logic conditions—a logic zero being indicated by the display of an actual numeral '0' and a logic one state being displayed as an actual numeral '1'. Above all, the presence of a pulse or of a pulse train is displayed by the alphabet 'P'. This probe thus differs from some other commercially available probes in which the presence of a logic zero or logic one is indicated by the glow of LED (light emitting diode) lamps.

The digital probe being discussed has been designed primarily for use in digital circuits based on the most popular TTL logic (transistor transistor logic). The TTL ICs are most widely used and have become a very big trend setter in the field of digital electronics.

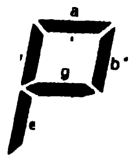
In TTL logic the worst case logic zero condition is any voltage between 0V and 0.8V, and the worst case logic one condition is any voltage from 2V to 5V. Voltages greater than 0.8V and less than 2V do not define any logic condition and hence in TTL circuits such voltages can be termed as 'incorrect logic.' The logic probe detects and displays the true logic zero and logic one conditions. For incorrect logic conditions or open circuit conditions the display is simply blanked off, i.e. neither '0' nor '1' is displayed.



(a) Segments configuration

(b) Indication of logic '0' condition

(c) Indication of logic '1' condition



(d) Indication of pulse condition.

(e) Indication of incorrect logic condition or open circuit condition
(All segments are off)
(The decimal point has been used as a 'power on' indicator)

Fig. 1: Segments configuration and the resultant indications obtained.

For the indications of the logic conditions a 7-segment common cathode LED display has been used in this probe. A

Mr G.L. Kataria, EFY's contributing editor, is a keen hobbyist himself. Now a lecturer in Delhi, he obtained a diploma in electrical communication engineering and topped the list of candidates. His constructional projects on 'Electronic Digital Clock' and 'Electronic Pocket Calculator' published in the May and November issues last year fetched tremendous response from EFY readers.

common anode LED display may instead be used with some modifications. The segments configuration and the indications obtained are as shown in Fig. 1. The segments 'a', 'b', 'g' and 'f' glow for the indication of the actual '0' (zero) and segment 'e' glows for the indication of the actual '1' (one). The combined segments 'a', 'b', 'g' and 'f' along with segment 'e' glow to give the indication of a single pulse or a pulse chain. The incorrect logic or open circuit condition (the probe tip not connected anywhere) is indicated if all the segments remain off. The decimal point has been used as a 'power on' indicator.

Fig. 2 shows the complete circuit of the direct reading logic probe. Diode D1 and gates 1, 2 and 3 form the circuit that detects logic zero condition. Diode D1 ensures that for voltages between 0V and 0.8V the logic zero detecting circuit becomes active while for voltages above 0.8V it remains inactive Diodes D2 and D3, transistor T1 and gate 4 form the circuit that detects logic one condition. D1, D2 and T1 ensure that for all voltages between 2V and 5V the logic one circuit becomes active while for voltages below +2V it remains inactive. Thus, for voltages greater than 0.8V and less than 2V both the detecting circuits remain inactive.

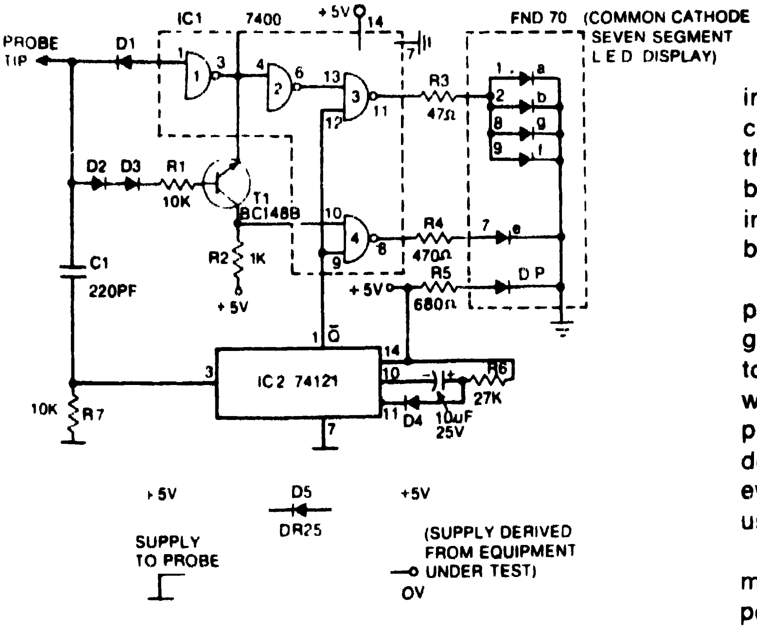
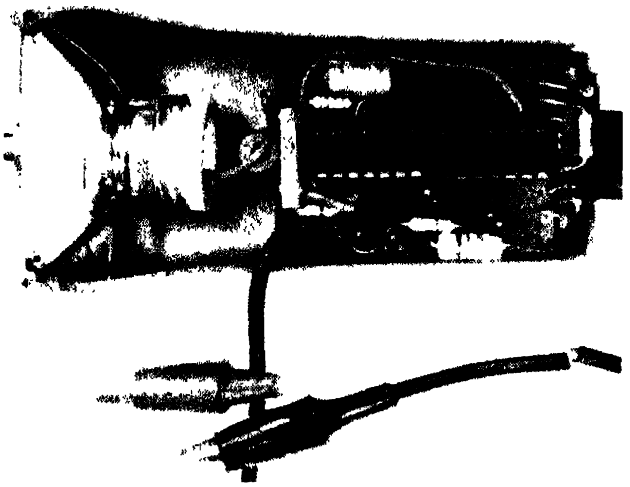


Fig. 2: Complete circuit diagram of the direct reading logic probe.

PARTS LIST

IC1—7400 integrated circuit (Quad two input NAND gate)
IC2—74121 integrated circuit (monostable)
(pin 7 is the ground terminal and pin 14 is for + 5V, for both the ICs)
D1-D4—Any silicon diode like 1N914 or 1N4148
D5—Germanium diode DR25
Display used—FND 70
R1, R7—10 kilohm resistor
R2—1 kilohm resistor
R3—47 ohm resistor
R4—470 ohm resistor
R5—680 ohm resistor
R6—27 kilohm resistor
C1—220 pF ceramic capacitor
C2—10 μF, 25V electrolytic capacitor
Misc: A small needle-like probe tip, enclosure such as a miniature battery case, a small piece of laminate sheet for mounting the components, shielded single-core flexible wire, two small crocodile chips for connecting to power supply



The components C1, R7, IC2, C2, R6 and D4 constitute the pulse detecting circuit. Once IC2 becomes active, it causes gates 3 and 4 to drive the segments 'a', 'b', 'g', 'f' and 'e' so as to display the letter 'P' for about half a second—the period for which the monostable IC gives output, once a pulse is applied at its input terminal (pin 3). The monostable IC2 can detect pulse width down to about 50 nano-seconds. Thus, even a single pulse of such a small duration can be detected using this logic probe.

The NAND gates 3 and 4 have been used a bit in an unusual manner—here they are sourcing a large current (about 3 mA per segment of LED display) which has been restricted by the resistors R3 and R4. Diode D5 has been used to save the logic probe from getting damaged in case the supply terminals are connected to the wrong polarities. Supply voltage for the probe is obtained directly from the equipment under test.

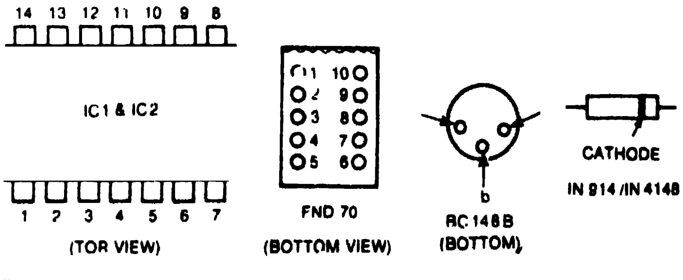


Fig. 3: Pins configuration of devices used.

The wiring and layout of the components is not very critical. The prototype was housed in a small plastic torch case, making it very handy and easy to use. □

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May — Tape Recorders Industry & Buyers' Guide
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Their products will be listed in the guide, free of cost and obligation, provided the information is authentic and supported by literature. Information for the buyers' guide should reach us *latest* by 20th of the previous month.

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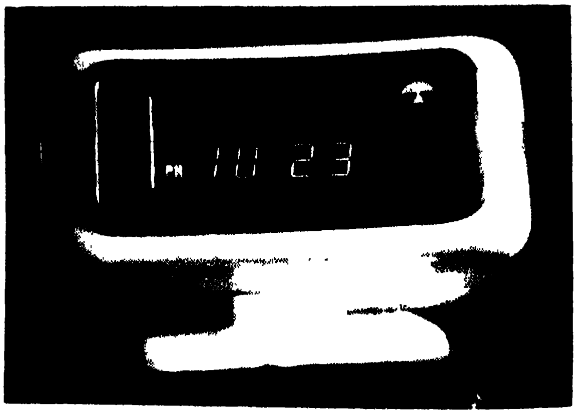

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DIGITAL INSTRUMENTS
Buyers' Guide

Manufacturers of some popular digital electronic instruments in India, as per our records and investigations, are being listed here. If there are any manufacturers of these instruments who have been left out, inadvertently, in spite of our efforts, they are requested to send us information about their products, for future use, at their earliest convenience.

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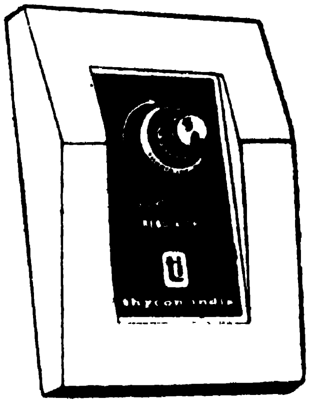

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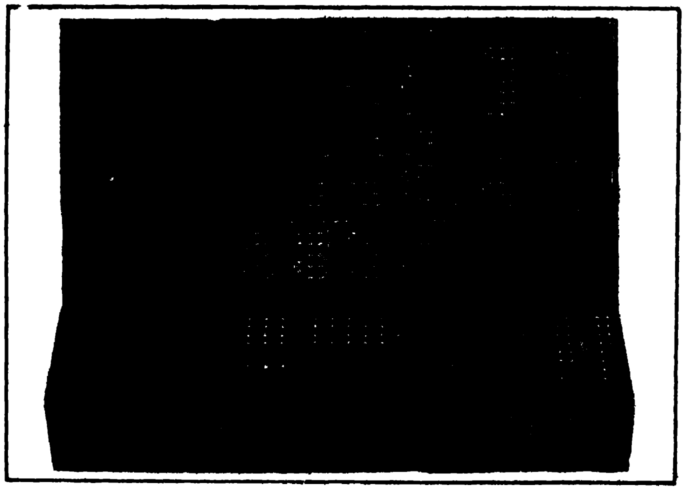
Model CT-11



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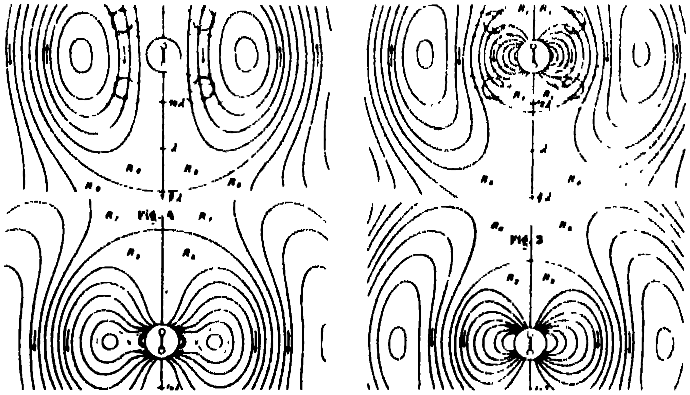
MEET SOME PIONEERS OF RADIO

The story of radio is a long one with many landmarks. It is also, like that of most scientific discoveries, an international one with scientists from many countries each making their contribution towards this wonderful technique which today has so many applications and to which we owe so much. This article highlights the contributions of just a few pioneers of radio; there were others who might also have been mentioned but space does not allow us to describe their contributions here.

The story began perhaps with Joseph Henry (1797 - 1878), an American physicist, who discovered in 1842 that electrical discharges were oscillating. A gigantic step forward was that due to James Clerk Maxwell (1831 - 1879), a Scottish physicist and one of the great mathematical geniuses of the 19th century. His treatise on "Electricity and Magnetism" was first read as a paper to the Royal Society in 1864, and published in fully developed form in 1873. It has been called "one of the most splendid monuments ever raised by the genius of a single individual." By purely mathematical reasoning. Maxwell showed that all electrical and magnetic phenomena could be reduced to stresses and motions in a medium, which he called the ether. Today we know that this "imponderable electrical medium" does not exist in reality, any more than the equator of the geographer or the average man of the statistician. Yet the concept of an ether helped greatly, and allowed Maxwell to put forward his theory that the velocity of electric waves in air should be equal to that of the velocity of light waves, both being the same kind of waves, merely differing in wavelength. This we know today to be an elemental truth, yet to Maxwell must go the honour of having first shown it to us in pure mathematical form.

In 1857 Feddersen demonstrated that if an electrical condenser is discharged into a conductor, oscillations are set up which give rise to intermittent spark phenomena. Twenty - one years later, in 1878, David Edward Hughes (1831 - 1900), an Anglo - American physicist, made another important discovery in the pre - history of radio and its essential components; he found that a loose contact in a circuit containing a battery and a telephone receiver (invented by Bell in 1876) would give rise to sounds in the receiver which corresponded to those that had impinged upon the diaphragm of the mouthpiece. Hughes "microphone" consisted of a carbon rod resting in grooves of two carbon blocks; from it developed many of the early carbon microphones of both telephone and radio. In 1883, George Francis Fitzgerald (1851 - 1901), an Irish physicist, suggested a method by which electromagnetic waves might be produced by the discharge of a condenser.

Next we must turn to Heinrich Rudolph Hertz (1857 - 1894), famous German physicist, who was the first to create, detect and measure electromagnetic waves, and thereby experimentally confirmed Maxwell's theory of "ether" waves. In his experiments he showed that these waves were capable of reflection, refraction, polarisation, diffraction and interference. They corresponded precisely in their behaviour to waves of light. Hertz produced his waves, soon to be called by others "Hertzian waves" from the sparks of an induction coil, and in order to study some of their properties he employed a zinc mirror. He described one of his experiments, in 1888 - 1889, as follows:



Pictures of the lines of flux around an oscillating dipole from the original paper of Heinrich Hertz. He was the first to create, detect and measure electromagnetic waves, and in 1887 Hertz experimentally confirmed J.C. Maxwell's theory of "ether" waves. His predictions and Heinrich Hertz's experiments created the basis of modern radiocommunications. (Illustration: Deutsche Bundespost).

"The height of the (parabolic) mirror was thus 2 metres, the width of its aperture 1.2 metres and its depth 0.7 metre. The primary oscillator was fixed in the middle of the focal line. The wires which conducted the discharge were led through the mirror; the induction coil and the cells were accordingly placed behind the mirror so as to be out of the way. If we now investigate the neighbourhood of the oscillator with our conductors, we find that there is no action behind the mirror or at either side of it; but in the direction of the optical axis of the mirror the sparks can be perceived up to a distance of 5-6 metres." The half wave length of this experiment was about 30 cm.

But Hertz's experiments were half a century in advance of his time, and belong to the field we now call microwave optics. Many repeated them and extended them, typical amongst them being Edouard Sarasin (1843 - 1917) and Lucine de la Rive (1834 - 1924) at Geneva, Antonio Giorgio Garbasso (1871 - 1933) and Emil Aschkinass (1873 - 1909) at Berlin, Jagadis Chunder Bose (1858 - 1937) at Calcutta and Augusto Righi (1850 - 1920) at Bologna. We shall see in a moment that only Righi had an indirect influence on the technology of radio, as a young Italian by the name of Guglielmo Marconi (1874 - 1937) was stimulated by his books and lectures.

The next most important event was a lecture given to the Royal Institution in London by Oliver Joseph Lodge (1851 - 1940) on 1 June 1894; it was called "The Work of Hertz and Some of his Successors," it was widely reported at the time, and was to have far - reaching consequences. Lodge, Professor of Physics at the new University of Liverpool, had himself worked extensively in the field of electromagnetic waves and was the first to comment on the phenomena of resonance or tuning. In 1898 he took out a patent on an adjustable inductance coil in the antenna circuit of a wireless transmitter or receiver, or in both, in order to tune one with the other. This patent won him a high place in the history of wireless. His sharply tuned resonance circuits were a substantial advance over Hertz's relatively primitive arrangements, but Lodge himself, like Hertz with heavy academic commitments, had not the time to develop his ideas on wireless telegraphy and never made an attempt to transmit any intelligent signals with electromagnetic waves.

Guglielmo Marconi's first transmitting apparatus, with a copper sheet aerial. An impression by the artist Steven Suprrier of Guglielmo Marconi's demonstration on Salisbury Plain, England, in 1896 to officials of the Post Office and the Armed Services (Illustration, Marconi Company)

Alexander Stepanovitch Popoff (1859 - 1906) was one of the many who read Lodge's lecture and was inspired by it. Popoff was in 1895 lecturer in physics at the Russian Imperial Navy's Torpedo School at Kronstadt near St. Petersburg. He experimented with Branly coherers, set up a receiver with a protruding wire in 1895, and read a paper about it, "On the Relation of Metallic Powders to Electric Oscillations," at the meeting of the Russian Physico - Chemical Society on 25 April (May 7, New Calendar) 1895. By means of this equipment, Popoff could register electrical disturbances, including atmospheric ones; and in July of the same year a similar instrument with an ink recorder was installed at the Meteorological Observatory of the Institute of Forestry at St. Petersburg.

Marconi, at the age of twenty in 1894, was well acquainted with the work of Hertz, Branly, Lodge and Righi. He began experimenting in the spring of 1895 on his father's estate at the Villa Grifone, near Pontecchio, Bologna. The idea had occurred to him that Hertzian waves might be the basis for a means of communication, signalling with them the dots and dashes of the Morse alphabet. Once he had convinced his father of the practical nature of his ambition, he received from him all the financial support he needed.

In his first experiments, he used an ordinary spark induction coil and home - made coherers of the Branly type. To turn the discharge on and off, he placed a telegraph key in the primary circuit of the induction coil, and thus produced short or long trains of sparks. He could soon detect these dots and dashes all across the room, and in the summer of 1895 he moved out into the garden. In order to increase the performance and range of his transmitter, he followed previous experiments by others: he attached on one end of his transmitter circuit an elevated metallic object, the antenna, and to the other end a metal plate buried in the ground. He could now signal across the whole garden, and he soon found that there was a direct relationship between the height of the antenna and the distance of transmission.

Marconi made important improvements in the components of his system, particularly in the design of his coherers. He also put a relay in series with it, which actuated the tapper of his coherers, and worked a telegraphic printing instrument to record the received signals. And here is perhaps the best place in our story to pay tribute to Edouard Branly (1844 - 1940) a great French physicist, officially described in France as "Inventeur de la Telegraphie Electrique sans Fil." His great contribution was the discovery of the coherer, that small fragile glass tube, looking like a thermometer, but filled with metal powder.

Branly found that electromagnetic waves, produced as much as 25 metres away from it, caused the individual metal particles in his coherer, first iron and later nickel and silver, to cohere and thus allow the passage of a current through them. A galvanometer was the instrument he used to show this effect; Marconi improved this greatly by using a telegraph printer. But the metal particles had to be separated again, and therefore an electric tapper, a tiny hammer precisely like that used in any electrical bell was added to the coherer. When it struck the glass tube it decohered the particles again, and thus stopped the current from the batteries.

Each successive impulse reaching Marconi's antenna produced the same phenomena in the coherer, first the coherence of the particles, then their decherence, and hence the recording of the dots and dashes. Marconi used tightly fitting silver plugs in his glass tube, which he evacuated and sealed and thus the coherer became the first of many sensitive devices to receive wireless telegraphy. Before Marconi left Italy, to continue his work in England, he had reached a transmission distance of the order of 1 kilometer. ☐

CIRCUIT IDEAS

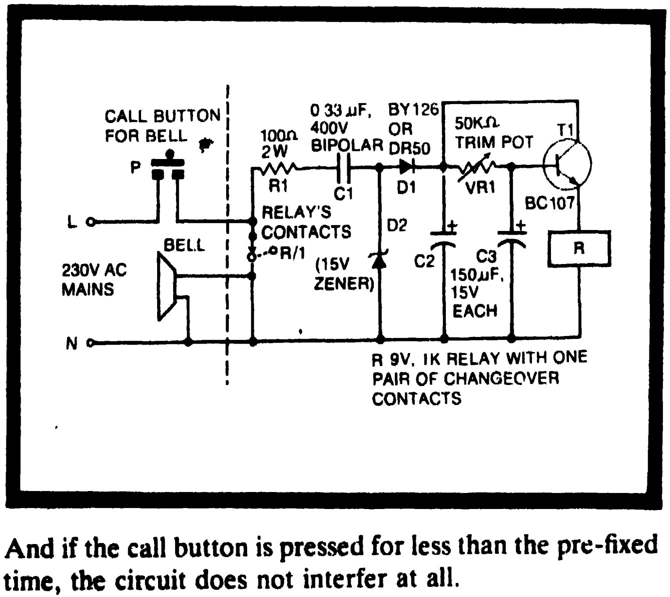
Protect the Calling Bell and Ears Too

Do you get annoyed by the continuous ringing of your calling bell when someone in a hurry, or may be just a child making mischief, sends you running to the front door as if in response to a fire alarm. Often it is for a trivial reason.

You can, if you wish, now feel at ease and also protect your bell's coils which may not be built for the 'fire-alarm' use by using the circuit shown below.

When the call-button for ringing the bell is pressed by someone, the bell is energised but simultaneously the protection circuit also gets powered. Components R1, C1, D1, D2 and C2 form a transformerless DC power supply arrangement. Components VR1 and C3 form a delay circuit whose output is applied to the base of transistor T1. After the pre-fixed delay—the maximum time for which you would like the bell to ring—the relay connected as a load to the transistor is energised. The relay contacts which normally remain closed, open on energisation and disconnect the power supply from the bell. The trim pot VR1 may be adjusted to obtain a desired delay period.

You would notice, as soon as the call button is released by the visitor, the power to the relay is also removed and relay's R/1 contacts come to their normally closed position.



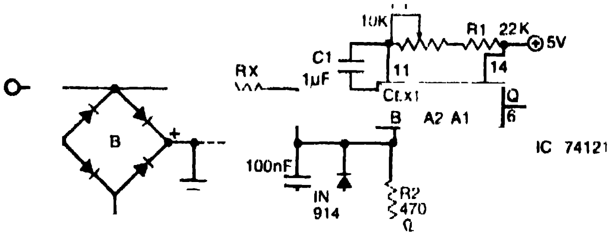
And if the call button is pressed for less than the pre-fixed time, the circuit does not interfer at all.

The whole circuit can be assembled in a small box and fixed just near the bell or buzzer so that it may not be conspicuous at all.

D. VENKATASUBBIAH

Clock Interference Suppression

Digital instruments, especially clocks, in which timing pulses are derived from the 50Hz mains frequency are very sensitive to mains interference. An excessive amount of interference can often cause a clock to gain several minutes per hour. Much worse, it can interfere with the operation of a counter, giving erratic readings. An adequate solution is offered by the circuit given here; if it is used in series with the clock the latter will always receive a 'clean' 50Hz pulse train.



After the 50Hz supply has been positively rectified, the signal is fed to the trigger input of a monostable multivibrator 74121IC. The values of C1, R1 and P1 are chosen so that the pulse width of the monostable is just under 20 ms.

Adjustment is simple: after the clock has been connected, P1 is first set to its maximum value; the clock should then run at half speed, because alternate 50Hz input pulses occur whilst the monostable is still triggered and have no effect. Then P1 is turned back until the clock begins to run normally. The value of Rx depends on the supply voltage. It must be chosen so that a voltage of no more than 5V peak to peak occurs on pin 5 of the IC. If the voltage across the smoothing capacitor C is measured, Rx can be calculated by means of the formula:

$R_x = 100 (V_c - 5)$ ohms

P.K. SOOD

Have You Any Idea?

Do you have any circuit idea which you feel is worth sharing with the other EFY readers?

If so, please do put it down neatly on a piece of paper and mail it to: The Managing Editor, Circuit Ideas, Electronics For You, 303 Dohil Chambers, 46 Nehru Place, New Delhi 110019.

A token honorarium (minimum Rs 25) will be paid for the ideas found acceptable for publication.

BEL Introduces COS/MOS Digital ICs

Bharat Electronics Ltd, Bangalore now introduces the much awaited COS/MOS (Complementary Symmetry Metal Oxide Semiconductor) digital integrated circuits for use in professional and industrial applications. COS/MOS devices exploit to the fullest extent the advantages offered by complementary symmetry circuits, in addition to their own inherent characteristics. The technological innovation has resulted in realising commercial production of COS/MOS digital ICs that are characterised by their micropower quiescent operation, moderately fast propagation, excellent noise immunity, large fan out capability and wide supply voltage range operation.

Presently COS/MOS circuits of medium scale integration (MSI) like flip-flops, counters and of large scale integration (LSI) like microprocessors, memory chips etc, are replacing the historic T^2L ICs in applications especially where high noise immunity and low power consumption are of paramount importance. The circuit of a basic COS/MOS inverter in complementary symmetry configuration is shown in Fig. 1(a) and its transfer characteristics in Fig. 1(b).

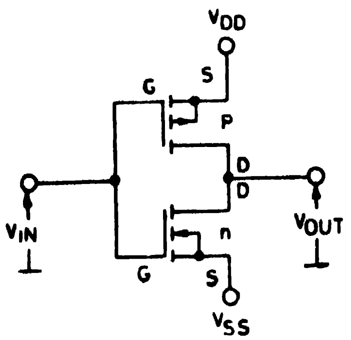


Fig 1(a)

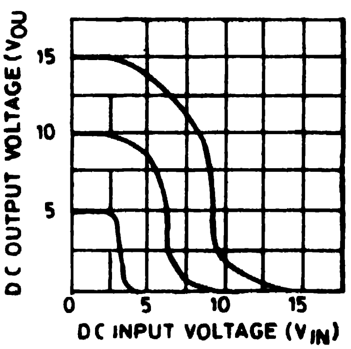


Fig 1(b)

The gates of the n- and p-channel MOSFETs are connected together to form the control terminal and the drains are connected together to form the output. The p-channel source is given a higher potential with respect to the n-channel source. When the voltage at the input of the inverter is low (logic 0) the p-channel MOSFET conducts and the n-channel MOSFET is 'off'. This results in the output being high (logic 1). When the input on the other hand is high (logic 1), the situation is reversed and the output goes low (logic 0).

Due to the very high input impedance of the MOS devices, the realisable output voltage swing is almost the full supply voltage for logic switching. The devices are characterised by high noise immunity, typically 45% of the supply voltage, as illustrated by their transfer characteristics of Fig. 1(b).

The high input impedance and low channel resistance result in a low static power dissipation, typically of the order of the 0.1 to 0.5μW. However, under dynamic conditions, for a short period during transition, both devices are momentarily turned on, resulting in a minute power dissipation, which is dependent on: (a) supply voltage, (b) switching frequency, and (c) load capacitance. The propagation delay, a function of supply voltage and load capacitance, diminishes with decreasing load capacitance and increasing supply voltage.

Typical electrical characteristics of the devices in the BEL's present COS/MOS series are given below:

ELECTRICAL CHARACTERISTICS OF BEL'S COS/MOS ICs

1.	DC supply voltage range, (VDD - VSS)	3V to 15V
2.	Output voltage	
	(a) Low level	0.01V
	(b) High level	VDD -0.01V
3.	Output drive current @ VDD - VSS = 10V	
	(a) N-channel (output = logic 0)	0.6 mA
	(b) P-channel (output = logic 1)	1.2 mA
4.	Propagation delay @ VDD - VSS = 10V	25 nS
5.	Transition time @ VDD - VSS = 10V	
	(a) Low to High level, tTLH	40 nS
	(b) High to Low level, tTHL	50 nS
6.	Input current	10 pA
7.	Input capacitance	5 pF

COS/MOS DEVICES THAT ARE PRESENTLY AVAILABLE

Type No.	*Description*
CD 4011 AE	Quad 2-input NAND gate
CD 4012 AE	Dual 4-input NAND gate
CD 4013 AE	Dual 'D' Flip-Flop
CD 4018 AE	Presettable divide by 'N' counter
CD 4023 AE	Triple 3-input NAND gate
CD 4027 AE	Dual J-K master-slave flip-flop
CD 4009 AE	HEX Buffer/converter
CD 4002 AE	Dual 4-input NOR gate
CD 4007 AE	Dual comp. pair plus inverter
CD 4045 AE	21 stage counter.

The different CD 4000A series COS/MOS devices that are available from BEL at present in DIP plastic package are listed. Many more devices of the series are presently under development and their availability will be communicated later. ☐

Courtesy: BELNEWS

COBOL PROGRAMMING (4)

R. Ramaswamy and T. V. Krishnamurthy

ADD Statement

The Add statement enables us to find the sum of two or more numeric fields and store the result. The Add format can be given in the following two forms:

$$\text{Add}\ \left\{\begin{array}{l}\text{literal-1}\\ \text{identifier-1}\end{array}\right\},\ \left[\begin{array}{l}\text{literal-2}\\ \text{identifier-2}\end{array}\right]$$

$$\ldots\text{TO}\ (\text{identifier-m}),\ [\text{identifier-n}]$$

$$\text{Add}\ \left\{\begin{array}{l}\text{literal-1}\\ \text{identifier-1}\end{array}\right\}\ \left\{\begin{array}{l}\text{literal-2}\\ \text{identifier-2}\end{array}\right\}$$

$$\ldots\text{GIVING}\ (\text{identifier-m}),\ [\text{identifier-n}]$$

In the first format all the operands preceding the word TO are added together and the result is added to each of the item following the word TO and stored in the respective fields. For example, if we write.

ADD OLD-STOCK TO MEAN-STOCK

the old stock will be added to the value already in the mean stock and the result stored in the mean stock field. The value of the field preceding the word TO is left unchanged. If we write

ADD ALLOWANCE, SPECIAL-PAY TO SALARY

the value of allowance and special pay will be added together and the same will be added to the salary and stored in the field of the salary.If the values of the three fields before computation are 23.00, 47.00 and 200.00 respectively, their values after computation will become 23.00, 47.00 and 270.00 respectively. Suppose, we write

ADD ALLOWANCE TO SPECIAL-PAY, SALARY

the value of the three fields after computation will become 23.00, 70.00 and 223.00 respectively.

In the second format also the operands preceding the word GIVING are all added together and the result is stored in each of the fields succeeding the word GIVING. The difference is that there is no further addition with the values already present in the fields succeeding the word GIVING. The old values, if any, are simply replaced by the total obtained from the fields on the left of the word GIVING. Suppose, we write

ADD A, B GIVING C

and if the original values of the three fields are 23, 47 and 200 respectively, the values of the three fields after computation will become 23, 47 and 70 respectively. Another advantage in this format is that the giving field or the storing field can be given editing specifications so that the result can be stored in the edited form.

> **Note:** Braces ({ }) enclosing a number of items indicate that one of the items must be used. Square brackets indicate that the enclosed items are optional as required by the program. When the brackets contain more than one item, one or more may be used as required.

Rounded option

When an arithmetic operation is performed the result may contain more decimal places than provided in that field. For example, if the result of a calculation comes out as 450.376 and if the field has provision for only two decimals, the number will be stored as 450.37 after truncating the last digit. It is more accurate to round off the number to the second decimal place, and this can be specified by the ROUNDED option. Rounded specifications prevent truncation after decimal point alignment, if the number of digits to the right of the decimal place exceeds the number of positions allotted in the result item. When ROUNDED is specified the least significant digit of the retained result is incremented by 1 if the most significant of the excess digit is 5 or greater. The following examples will show the use of ROUNDED option.

Result of calculation	*Result without option*	*Result with Rounded option*
523.467	523.46	523.47
276.985	276.98	276.99
256.301	256.30	256.30

In a typical ADD statment, the ROUNDED option is given as follows:

ADD A, B, C GIVING S ROUNDED
ADD A, B, C TO D ROUNDED

Size error option

A size error condition is said to exist if after decimal point alignment, the value of the result cannot be contained in the result item. This applies only to the integer part of the answer and not to the decimal position, since excess decimal places will be truncated. If a result 2579 is to be placed in a field with only three digits capacity, a size error condition arises. Checking for size error condition is carried out

---

This is the fourth part of the serial on Cobol Programming being published regularly since January 1978. *Mr R. Ramaswamy* is lecturer in physics at Thiagarajar College of Engineering, Madurai and Mr *T. V. Krishnamurthy* is system programmer with the K. C.P. Limited, Madras.

Earlier they co-authored a serial on 'Computer Language: Fortran IV' which was published in the January 1976 to May 1976 issues of EFY. Their first co-authored serial on 'Computer Languages' in EFY appeared in the May 1974 to April 1975 issues. They have also jointly authored a book entitled 'Teach Yourself Computers.'

only on the final result of the calculation and is done after rounding if the rounded option has been specified.

Rounding option precedes the checking for the size error condition. If a size error occurs during the execution of a statement not specifying the size error option, the result is unpredicatable. A size error option does not alter the result. By giving this option the computer is instructed as to what is to be done in case the size error condition arises during computation. One specification may be to ask the computer to stop. Another specification may be to ask the computer to stop. Another specification may be to ask the computer to go to some other statement somewhat as follows:

ADD TO B ON SIZE-ERROR GO TO OVERFLOW

ADD A TO B ON SIZE-ERROR STOP

Subtract statement

This statment is used to subtract one or more values from another value. The Subtract statement can be written in the following two formats:

```
SUBTRACT{ identifier-1 }      [identifier-2]
        { literal-1    }      [literal-2   ]
 ...FROM{identifier-m} [identifier-n]
SUBTRACT { identifier-1 }     [identifier-2]
         { literal-1    }     [literal-2   ]
 ...FROM(identifier  -m)  GIVING(identifier- n .)
```

In the first format, all the operands preceding the word FROM are added together. This total is then subtracted from the item following the word FROM and the result is stored in each of the operands. For example, if we write

SUBTRACT A, B, C FROM D, E, F

the values of the first three fields will be added together and this sum will be subtracted from each of remaining fields in turn. Results stored in D, E and F are (D-(A + B + C)), (E − (A + B + C)) and (F − (A + B + C)) respectively. The values originally stored in D, E and F are lost. In the second format all the operands preceding the word FROM are added together. This total is then subtracted from the operand immediately following the word FROM and the result is stored in the data item specified following the word GIVING. It must be noted that the value of the identifier-m is not changed.

In the previous example, if we want to retain the value of D, we can write

SUBTRACT A, B, C FROM D GIVING K

The above statement causes the computation (D − (A + B + C)) and storage of the result in the location K. Only the initial value of K is lost, but not the values of A, B, C and D. Only one identifier may appear after the word FROM and one after the word GIVING. In some computers more than one identifier can be present after the word GIVING. In that case each identifier will store only the value of K as computed above. Rounded specification and size error option can be given to the result of computation. For example, one can write

SUBTRACT A, B, C FROM D GIVING K ROUNDED, ON SIZE ERROR GO TO PARA-2.

Multiply statement

This statement is used to obtain the product of two data item values. The Multiply statement can be written in the following two forms;

```
MULTIPLY        { identifier-1 }
                { literal-1    }
BY              (identifier-2 ), [identifier-3]

MULTIPLY        { identifier-1 }
                { literal-1    }
BY             {  identifier-2  }
               {  literal-2     }
GIVING     identifier-3
```

In the first format, the value in the identifier-1 or the value of the literal-1 is multiplied by the value of the identifier-2 and the result is stored in the identifier-2. Similarly, the identifier-1 is multiplied by the identifier-3 and the product is stored in the identifier-3. That is, each product replaces the corresponding multiplier. For example, if we write

MULTIPLY A BY B, C, D

The products AB, AC and AD are stored in the locations B, C and D respectively.

In the second format, the single product is stored in each of the identifier following the word GIVING. The value of the first two fields are not changed by the execution of the statements. Suppose we write

MULTIPLY A BY B GIVING C, D, E.

the product AB is stored in each of the locations C, D and E, removing the original contents of C, D and E. Rounded specifications and size error option can be given for the final result.

Divide statement

This statement is used to divide one data item by another data item and calculate the quotient and the remainder if required. The DIVIDE statement can be written in the following five forms:

```
DIVIDE{ identifier-1 }INTO (indentifer-2), (identifier-3)
      { literal-1    }
DIVIDE{ indentifier-1 }INTO  (identifier-2),  GIVING
      { literal-1     }                      identifier-3
DIVIDE{ identifier-1 }  INTO  (identifier-2), GIVING
      { literal-1    }                       identifier-3
                         REMAINDER (identifier-4)
DIVIDE{ identifier-1 }  BY  (identifier-2)   GIVING
      { literal-1)   }                      (identifier-3)
DIVIDE{ identifier-1 }BY  (identifier-2)  GIVING
      { literal-1    }                     identifier-3
                          REMAINDER  identifier-4
```

In the first format, the value in the identifier-1 is divided into the identifier-2 and the quotient replaces the value of the identifier-2 discarding the remainder. The calculation can be summarised as follows:

$$\text{identifier-2} = \frac{\text{identifier-2}}{\text{identifier-1}}$$

Similarly, the identifier-3 is divided by the identifier-1 and the quotient is stored in the identifier-3, discarding the remainder. In the second format the single quotient obtained by dividing the identifier-2 by the identifier-1 is stored in each data item specified following the word GIVING. In the third format both the quotient and the remainder are produced. The fourth and the fifth formats use the word BY instead of the word INTO. This causes the identifier-1 to be divided by the identifier-2. In the fourth format the quotient alone is stored in each of the identifiers following the word GIVING. In the fifth format both the quotient and the remainder are produced. When we use the GIVING form both the dividend and the divisor are saved, whereas in other cases, the dividend is replaced by the quotient. Rounded and size error options can be given for the result in all cases. The following are examples of valid DIVIDE statements:

1. DIVIDE A INTO B
2. DIVIDE A INTO B GIVING C, D, E
3. DIVIDE B BY A GIVING C, D, E
4. DIVIDE B BY A ON SIZE ERROR GO TO OVER-FLOW
5. DIVIDE B BY A GIVING C, D, E ROUNDED
6. DIVIDE B BY A GIVING C REMAINDER D

Accept statement

The Accept statement is used to read low-volume data from a designated low-speed hardware device. The general format is as follows:

ACCEPT (identifier) FROM (mnemonic-name-1)

The mnemonic name is the programmer assigned name for the hardware device which is to accept the data. This name must have appeared in the Special Names paragraph of the environment division before it is used in the procedure division. The maximum length of data which the hardware device can transfer through this statement depends on the implementor.

This statement is usually used to give the computer messages from console. Occasionally this statement can also be used to give the computer messages from the card reader. With an accept statement only one card can be read at a time and after executing it the computer will output a message 'Awaiting Reply', and wait until the operator gives the next instruction manually. Thus we see that there is a wastage of computer time in using the Accept Statement and so this statement is used very sparingly except when the operator wants to give some special message to the computer.

Display statement

The Display statement is used to write a low-volume data on a designated low-speed hardware device. The general format is as follows:

$$\text{DISPLAY} \begin{Bmatrix} \text{literal-1} \\ \text{identifier-1} \end{Bmatrix}$$

UPON mnemonic-name-1

This mnemonic name is the programmer assigned name for the line printer which is to display the identifier-1 or the literal-1. If UPON and the succeeding words are not given, the display is made on the console typewriter. If the mnemonic name is given in the statement, it must have occurred in the special names paragraph of the environment divison. The Display statement is usually used in conjunction with the Accept statement. The Display and the Accept statements must be restrictively used, firstly because they take lot of computer time for execution, and secondly because they require the attention of the operator every time a line is accepted or displayed. The following are some of the valid Accept and Display statements:

ACCEPT KARD-IN FROM CARD-READER-1
DISPLAY KARD-IN UPON PRINTER-1
DISPLAY KARD-IN
ACCEPT KARD-IN

In the last two statements the transfer is through the console typewriter.

Move statement

The MOVE statement is used to transfer data or copy data from one computer storage location (identified by data name) to another storage location (identified by another data name). The general form of the statement is as follows:

$$\text{MOVE} \begin{Bmatrix} \text{data-name-1} \\ \text{literal} \end{Bmatrix}$$

TO (data-name-2) [data-name-3]...

The operand to the left of TO is referred to as the sending area, while the operands to the right of TO are referred to as the receiving areas. It must be noted that the contents of the sending area remain unchanged by the MOVE operation. The following are some examples of valid MOVE statements:

MOVE PAY-IN TO PAY-OUT
MOVE AREA-1, TO AREA-2, AREA-3, AREA-4
MOVE 'GAIN' TO FIELD-1

When one moves one data item to another data item, the size of the receiving field must be as large as the field being sent, otherwise the data will be truncated. Truncation is determined by the receiving field. When the receiving field is alphanumeric and smaller than the sending field, the excess right-hand characters of the sending field will be truncated. When the receiving field is numeric and smaller, excess left-hand characters of the sending field will be truncated. When the receiving field is alphanumeric and larger, the dats is placed in the leftmost positions of the receiving field. The remaining receiver positions are automatically filled with spaces. When the receiving field is computational and larger, the data is placed in the rightmost positions of the receiving field (rightmost sending digit goes to rightmost receiving digit etc). The remaining receiver positions are automatically filled with zeros. Numeric data moved into a field with edit symbols is handled according to the rules for numeric fields which we will be seeing later.

The following table summarises the valid and the invalid data movements:

Sending field	*Receiving field*	*Legality*
Alphabetic	Numeric	Illegal
Alphabetic	Alphanumeric	Legal
Numeric	Alphanumeric	Legal for integers only
Numeric	Alphabetic	Illegal
Alphanumeric	Numeric	Legal for integers only
Alphanumeric	Alphabetic	Legal for alphabetic characters only

Stop Statement

The STOP statement is used to make either a temporary stop or a permanent stop of the computer processing of a particular program. The general form is

$$\text{STOP}\begin{Bmatrix}\text{literal}\\ \text{RUN}\end{Bmatrix}$$

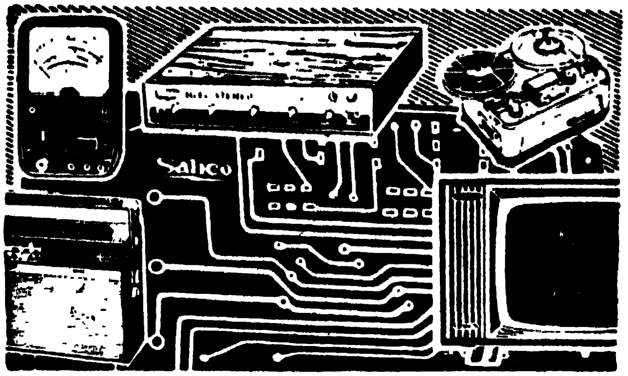
When a literal is used, the literal will be displayed on the console typewriter, so that the operator may know where the program has halted and take appropriate action for its further continuance. When the statement is given as STOP RUN the processing of the program is terminated permanently.

To be continued next month

Please note down this number:

6 3 5 2 8 3

You can ring up this number now to contact Electronics For You.



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—Managing Editor

DXING THE CONTINENT OF ASIA

R. Ram Mohan

The broadcasting in Asia poses a complex area for the DX listener to understand and identify due to its vast geographical area with scores of countries, many languages and stations. Majority of the stations are under the control of the government or an authority. Radio Republik Indonesia (RRI), Korean Broadcasting Services (KBS), Japan Broadcasting Corporation (NHK), Sri Lanka Broadcasting Corporation (SLBC), Broadcasting Corporation of China (BCC of Republic of China), All India Radio (AIR), are popular among them. Both the tropical frequencies and international bands are in use in Asia.

International broadcasters operate a few relay bases in Asia: British Broadcasting Corporation has at Singapore and Malaysia; Voice of America has its relay bases at Colombo (Sri Lanka), Poro and Tinang (Philippines) and Thailand.

Indonesia offers a fascinating area for DXing. Local and regional stations broadcast in the frequencies of 120, 90 and 60 metre bands; and the Home Service and the international stations in the higher frequencies. The familiar RRI slogan precedes the location of Studio. Your reception reports are verified by most of the RRI stations. Details of foreign service schedule can be had from: Voice of Indonesia, P.O. Box 157, Jakarta, Indonesia.

Here is a list of addresses of Asian broadcasters having External Services, from whom you can obtain their latest broadcasting schedules:

1. Radio Afganistan, P.O. Box 544, Kabul, Afganistan.
2. Radio Bangladesh, Overseas Services, 20 Green Road, Dacca-5, Bangladesh.
3. Voice of Free China (BCC), 53 Jen Ai Road, Section 3, Taipei, Taiwan, Republic of China.
4. Voice of Iran, Foreign Program Department, Tehran, Iran.
5. Israel Broadcasting Authority, Overseas Service, Jerusalem, Israel.
6. Radio Japan (NHK), Tokyo, Japan.
7. Radio Jordon, P.O. Box 909, Amman, Jordon.
8. Radio Kuwait, P.O. Box 397, Kuwait (Arabian Gulf).
9. Radio Malaysia, Overseas Service, Kuala Lumpur, Malaysia.
10. Radio Ulan Bator, CPO Box 365, Ulan Bator, Mongolia.
11. Radio Pakistan, External Services, 82-A Satellite Town, Rawalpindi, Pakistan.
12. Sri Lanka Broadcasting Corporation, P.O. Box 574, Colombo, Sri Lanka.
13. Voice of Viet Nam, 58 Quan su Street, Hanoi, Vietnam.

Bhutan

Radio N.Y.A.B., P.O. Box 1, Thimpu has the following latest (cf: EFY Sept. 1977) schedule: Sundays at 0830-0930 GMT on 7040 kHz and on Wednesdays at 1230-1330 GMT on 4690 kHz. To get QSL cards you have to include sufficient details of announcements, songs, news items etc, covering at least 15 minutes of the programme content.

Hints for Latin American DXing

As already said in LA DXing (cf: EFY Sept. '77), to identify a LA station is easy if you understand Spanish or Portuguese. Success can be achieved with only a minimum knowledge of these languages. The secret of this is to memorise a few key words often used by LA stations in announcements or time checks. You can master this technique with a little effort. Start with words like:

emisora (pronounced as: ay-mee-so-ra): STATION
estudios (es-too-dyos): STUDIOS
transmite (trans-mee-tay): TRANSMITS
frecuencia (fray-kwen-see-ah): FREQUENCY
hora (oh-rah): HOUR; *reloj* (reh-loh): CLOCK
el (ehl): THE (masc.) *la* (lah): THE (fem.)
las (lahs): THE (fem. plural)
desde (dehs-deh): FROM *de* (day): FOR, OF
esta (eh-stah): THIS *son* (sohn): THEY ARE
presenta (preh-sehn-tah): PRESENTS

Here is an example of a station's identification:
Esta es Ecos del Torbes, su emisora predilecta
This is Ecos del Torbes, your station favourite

How Latins tell time

The classical and the modern are two approaches to tell time in Spanish, the former mode being used widely in Latin America.

The classical approach—an hour is divided into two 30-minute halves. 'Plus half' comprising the first 30 minutes and 'Minus half' the last 30 minutes. To give the time in 'plus half' one simply gives the hour PLUS the minutes. To give time in the 'minus half' one goes to the approaching hour and gives the time as that hour MINUS the appropriate number of minutes. One says, "*es la una y dos minutos*" (ays-lah oo-nah ee des me-new-tohs). And if it is two hours and three minutes, one says, "*son las dos y tres minutos*" (sohn lahs dohs ee trays me-new-tohs). But if it is one hour and fifty-eight minutes, one says, "*son las dos menos dos minutos*" (sohn lahs dohs may-nohs dohs-me-new-tohs). Or if it is two fifty-eight, *"son las tres menos dos minute"* (sohn lahs trays may-nohs dohs me-new-tohs).

Note that only the first half-hour use the singular 'it is' or *es*. All others are plural: two hours, three hours etc, and require the plural *"son"*.

Most countries in Latin America use the twelve-hour system, exception being argentina and Chile. *"de la manana"* (of the morning): *"de la tarde"* (of the afternoon); *"de la noche"* (of the night).

The modern approach of telling time is commonly employed in daily usage in Latin America. "Nine forty" (*nueve cuarenta minutes*) or as "eleven-thirty" (*once treinta minutos*).

DX NEWS

Maldives

MIBS has put into operation five new transmitters of 7.5 kW (3 nos.) and 30 kW each of two transmitters. 1500-1730 GMT 4740 kHz commercial service with 7.5 kW. The 30 kW transmitter on 4754 kHz will be tested during November 78. 6150 kHz is used between 0500-0700 and 1100-1300 GMT, 7225 kHz between 0300-0500, 0900-1100, 9558 kHz between 0700-0900 GMT. During evening one can log the broadcast with clear reception in India. ☐

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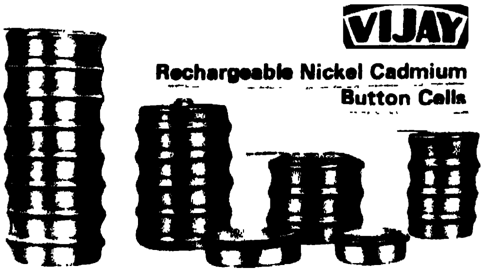

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Current and Future Plans of ETTDC

S.P. Agarwal

The Electronics Trade and Technology Development Corporation (ETTDC), a techno - commercial organisation in the public sector under the Department of Electronics, government of India, was set up in August 1974 with the main objectives of fostering foreign trade and indigenous technology by way of identifying new markets and new products in the field of electronics. During the short span of three years, the corporation has performed exceedingly well in its wide range of operations and has built up necessary infrastructural facilities for progressive growth of exports in electronics. The annual turnover has increased from Rs 18 million in 1975 - 76 to Rs 65 million in 1976 - 77, declaring a dividend of six per cent on the paid - up capital of Rs 3.5 million and bonus of Rs 20 per cent for its employees right from its inception. The trade volume is expected to exceed Rs 100 million, including exports of about Rs 15 million during 1977 - 78.

In addition to trading activities, its operations include development for import substitution and export, improving quality and design standards for exportworthy products, large-scale export production cooperations, technology transfer and consultancy services, information and market research, etc. The future plans and policies of the corporation are directed towards the promotion of exports by way of indentifying new markets and products, following up trade agreements with other countries, building up stronger base for mass production for internationally competitive products in quality as well as cost, and export of projects to developing countries.

Exports

The corporation is now exporting 20 items including voltage stabilisers, components, electronic test and measurement instruments, scientific calculators, computer software and cables to such countries as Bulgaria, Canada, Hungary, Iraq, Iran, Kenya, Kuwait, Poland, the USA, the UK, the USSR and West Germany. Collaborations with foreign partners in third country joint ventures for supply and erection of sophisticated communication systems such as satellite earth stations and microwave communication systems are being processed. Special steps are being contemplated to build up trade in far away countries such as Australia and Newzealand, and to set up a fully-owned subsidiary in Los Angeles in the USA for the promotion of exports.

President of India, Mr N. Sanjiva Reddy, talking to Mr R.M. Nayar, managing director, ETTDC at the ETTDC stall in the Indian Engineering Trade Fair, New Delhi held in February 1978.

As mentioned earlier, the main thrust to promote exports in future would be by way of indentifying new markets and new products. In fact, the corporation has been pursuing this philosophy in the past by way of participating in various international exhibitions/ fairs and buyer-seller meets in various countries.

The corporation was awarded a certificate of merit and a gold medal for the quality products exhibited at the Zagreb International Autumn Fair held in 1977 in Yugoslavia. Information and market research is also being considered as an important tool to promote exports. A nucleus for this activity is already functioning in the corporation and is now planned to be activated more vigorously. Table 1 indicates the growth of trade and future plans of ETTDC (1978 to 1983).

Imports

The items presently imported by the corporation include selected raw materials and components such as integrated circuits, special transistors, high voltage rectifiers and resistors, diodes, deck mechanisms for tape recorder industry, special cable wire etc, under Industrial Raw Material Assistance scheme to help particularly small industries; calculator chips and TV picture tubes as canalised items; special tape recorders, nuclear scanners, high frequency receiving tubes, computers and computer peripherals, etc. A major thrust is planned in the import of used plant and machinery to enable Indian manufacturers to balance their existing production lines and augment production.

Mr S.P. Agarwal is an assistant manager in the information and market research department of the Electronics Trade and Technology Development Corpn Ltd, New Delhi.

TABLE 1

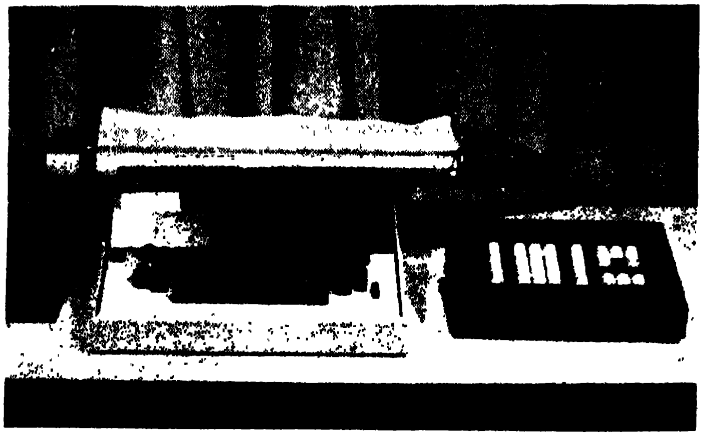
Growth of Trade and Future Plans

	ESTIMATES					
	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83
1. Turnover (Rs million)						
Import	113	135	150	180	220	260
Export	12	25	50	60	70	80
TOTAL	125	160	200	240	290	340
2. Equity (Rs million)	5.0	5.0	7.5	7.5	10.0	10.0
3. Government Loans (Rs million)	5.0	5.0	7.5	7.5	10.0	10.0
(A) Outlay on Technology Development (Rs million)	—	5.0	3.5	3.0	2.0	1.5
(B) Increase in Equity and Loans (Rs million)	—	—	5.0	—	5.0	—

Technology development

The Technology Development wing of the corporation has expanded its activities considerably to provide effective support for exports. The corporation identifies the gaps in technology, manufacturing processes, styling, testing and quality control procedures for various electronic products, particularly from the export point of view where quality and cost are important. Once such products are identified, an appropriate industry is located which could be entrusted with the developmental work keeping in view the long-range production possibilities. The corporation finances developmental projects carried out in collaboration with public/private sector units. In fact, the corporation has framed a comprehensive proposal concerning this philosophy of technology development and has been approved by Technology Development Council of Electronics Commission.

Several short-term and long-term developmental projects to produce additional exportable items and to achieve import substitution, some in collaboration with industries have been undertaken by the corporation. An electronic business and accounting machine has already been developed by ETTDC, in collaboration with an industry, which is its first venture for a large-scale import substitution in the country. The electro-mechanical-type of accounting and invoicing machine presently being imported by the corporation from Eastern Europe will now be replaced by this newly developed machine which is useful for organisations such as banks, business houses and hotels. The development of a data line monitor which will be another substantially export-oriented product, is also expected to be completed very shortly. The other projects under development for export promotion include development of AM/FM receiver, two-in-one and three-in-one combination sets, telephone subscriber instrument meeting CCITT specifications, low cost TV, etc.



An electronic business and accounting machine developed by ETTDC in collaboration with PSI Data Products.

Special efforts are being made to launch shortly export-oriented production ventures and a few of such projects are for the manufacture of electrolytic capacitors, cheap TV and computer memory stacks. Likely to be set up in various states in the country, these projects would generate employment for about 2000 persons. Possibilities of production cooperations for the export of TV tubes, consumer electronics, transreceivers, electronic calculating and accounting machines and allied components are also being explored with Egypt and Yugoslavia, as decided in the Tripartite Meet held in Cairo in December 1977 in which Mr R.M. Nayar, managing director of ETTDC represented India.

ETTDC is stepping up its areas of operation and a joint sector company has already been started with its capital participation which is expected to generate exportable products worth Rs 20 million per annum through its developmental and marketing efforts. Also, the corporation may take over a large electronics factory to provide the much needed manufacturing support for stepping up exports, sub-contracts, and maintaining a continuous stream of exportable electronic goods. ETTDC is also planning to step up its activities related to the development, production and export of high purity electronic materials such as copper beryllium, gallium, idium and selenium, and a proposal is being framed in consultation with Technology Development Council of Electronics Commission and Special Materials Project division (SMP) of Nuclear Fuel Complex at Hyderabad.

Quality of exportable products to compete in international market plays a vital role. ETTDC has been aware of this fact from the beginning and a nucleus for quality assurance services for exportworthy products has already started functioning at Delhi office, and a fully equipped export quality control laboratory will be set up by ETTDC shortly.

Technology transfer and consultancy services

The corporation has undertaken the activities related to transfer of technology from development organisations to industry or industry to industry in India and abroad. Action has already been initiated to transfer the technologies developed by ISRO group of laboratories and through the developmental projects funded by Technology Development Council of the Electronics Commission. Attempts are being made to explore the possibilities of rendering consultancy services in third countries and a few proposals have already been submitted to some of the developing countries.

The purchase of technology from abroad for the purpose of boosting up exports is another area where ETTDC will be active in the next five years. ETTDC is continuously striving to promote exports in electronics through its multi-dimensional activities such as specially organised production ventures, technological transfer and consultancy services, bilateral cooperation agreements now being entered into with many countries etc. □

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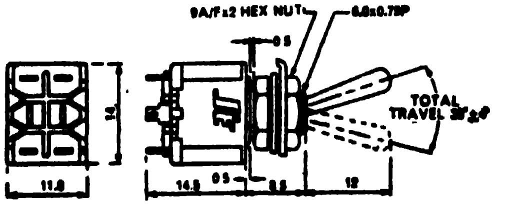
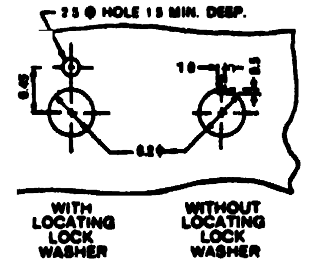


SWITCH .-T 2A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1.0
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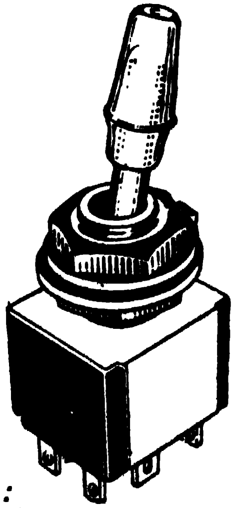

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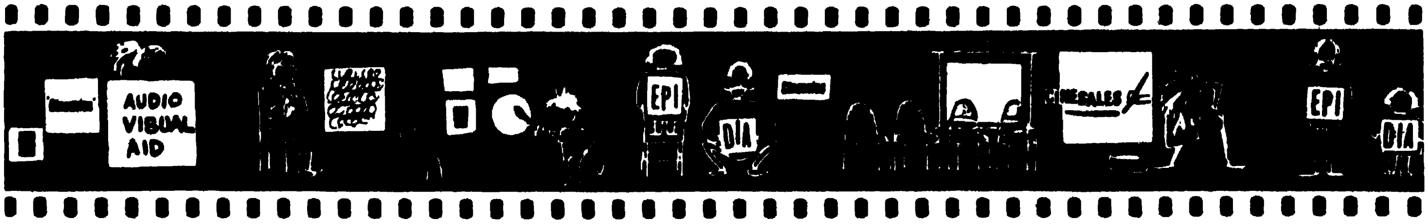

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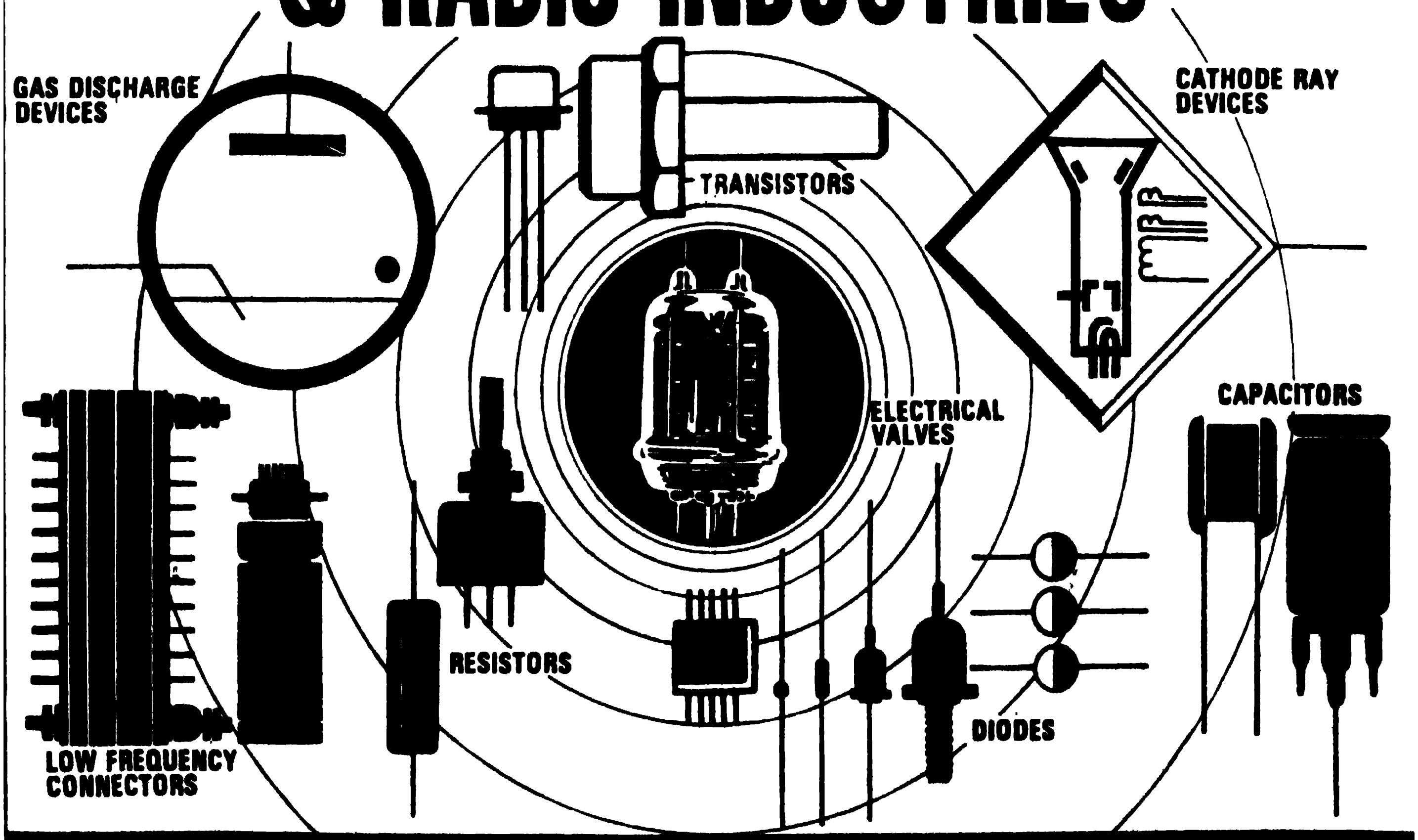

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COMPANY PROFILES

BEL Planning Further Expansion

Bharat Electronics has orders worth Rs 1800 million in hand for its equipment while its production capacity at present stands at Rs 600 to 700 million a year only. This means it would take BEL about three years to fulfill its commitments to date.

In view of the heavy bookings, and taking into account the projected demands after consultation with the minisfry of defence and other users, it has been estimated by the BEL management that the production capacity will have to be enhanced to about Rs 1100 million per annum within the next three years. Two new factories are therefore being proposed for consideration to the government to cover the gap quickly. BEL's Pune factory for producing image converter and image intensifier tubes for night vision applications is already in progress. It is expected to start production in 1979.

In the defence area, BEL is meeting Indian army's requirement of electronic equipment almost fully. Among its significant achievements is an interrogation equipment produced for the Indian air force to find out 'friend or foe?' "The 3D mobile radars under development will be the most modern available in the world" according to BEL's chairman and managing director, Mr C.R. Subramanian. "We don't deal in avionics. We deal only in ground equipment for the air force" he said, speaking to newsmen recently. As for the navy, its three Leander Frigates are completely equipped with three types of radar equipment produced in BEL. Each frigate carries over Rs 45 million worth of BEL equipment.

Besides supplying equipment for defence and civilian government departments. and undertaking turnkey projects, BEL has established itself as a major supplier of components for the consumer electronics industry. In 1977 - 78 its supplies to consumer electronics units in the form of components are estimated to be around Rs 180 million, according to Mr Subramanian.

During 1977-78 BEL doubled its exports to about Rs 150 million against last year's Rs 70 million. Thus, during 1977-78 over 20 per cent of its sales were in the form of exports, in monetary terms. Total production in BEL during the year is estimated to be Rs 780 million and sales around Rs 730 million.

The company lays a great stress on design and development. Its expenditure on R&D during 1977-78 amounted to Rs 37.8 million and it is planning to spend about Rs 45 million next year. It employs over 350 engineers just for design and development.

IBM Workers to Run Centres

With IBM winding up its operations in India, its employees have decided to form a new company to run its computer centres and card manufacturing units in the country. A proposal to this effect put forth to the government is reported to have been agreed to.

International Data Management, the new company proposed, would run the four present computer centres in New Delhi, Calcutta, Madras and Bombay, and the card manufacturing unit. Dr O.P. Mehra, chief executivedesignate of the newly formed company said that they had "the requisite experience, expertise and resolve to give customers IBM's level of service."

The government is belived to have advised IBM to sell out its rental. machines — at a price equivalent to about three months rental — to its customers or public sector undertakings interested in them. The government officials seem to be confident that the public sector Computer Maintenance Comporation would be able to maintain the IBM computers left behind.

ECIL Gets Two Orders From USSR

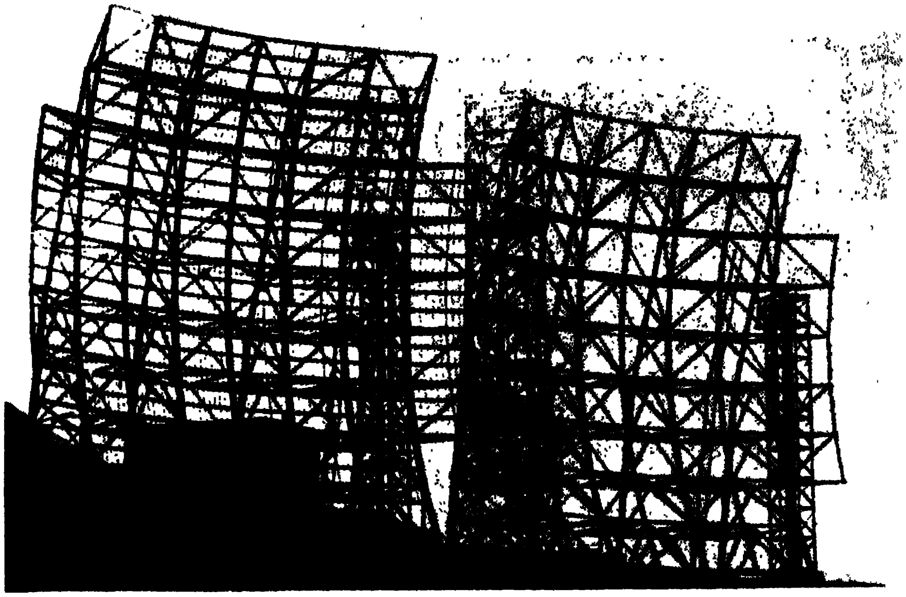
Electronics Corporation of India Limited (ECIL) has secured two prestigious export orders from the Soviet Union for the supply of tropo - scatter antennae and computer memory stacks.

The antennae export order, valued at Rs 5.9 million, envisages ECIL to supply two parabolic tropo - scatter antennae of 30 x 30m with associated feeds. The antennae which will be used for setting up the Indo-USSR tropo - scatter communication link between Srinagar and Dushanbe, will be designed and fabricated by ECIL using wholly indigenous knowhow.

The Indo-USSR tropo - scatter link,

one of the longest in the world with a path distance of 695 kilometres, will provide for direct communication between India and USSR without the need for a satellite. At present, the communication between the two countries is through satellite.

Under the second export order, ECIL will wupply about 1350 sophisticated memory stacks valued at Rs 36.5 million to the USSR over a period of two years. The first consignment will be delivered to the USSR by the end of 1978. These memory stacks will be integrated into the Russian computers.



Tropo scatter communication antenna system made by ECIL

ITI Rae Bareli Unit Inaugurated

The Rs 220-million switching equipment factory of the Indian Telephone Industries in Rae Bareli was inaugurated by the Union minister of communications, Mr Brij Lal Verma, on March 20. Speaking on the occasion, the minister said the factory would manufacture over 100,000 telephone lines per annum and by 1979-80 its turnover would be around Rs 200 million. The factory is expected to provide jobs to over 5000 persons when in full production.

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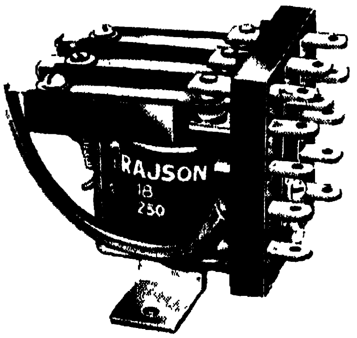

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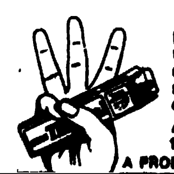

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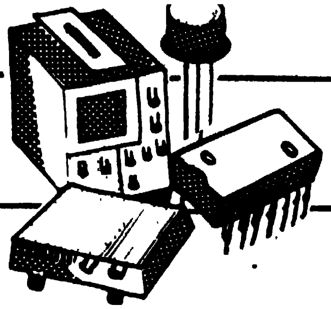


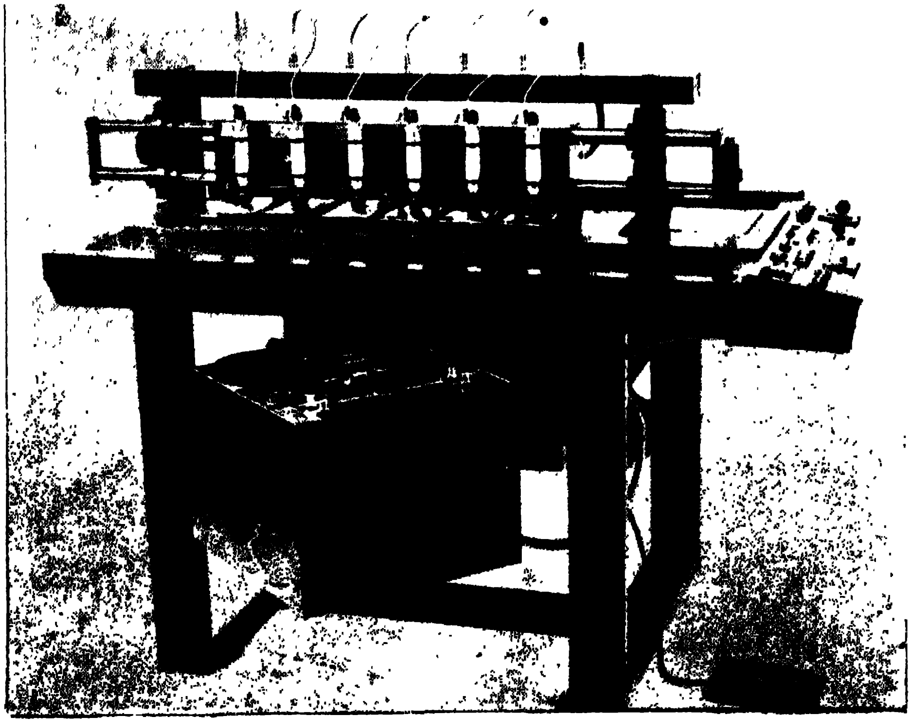
PRODUCT PROFILES

PCB MAKING MACHINE

Jurgen Seeback of Hannover has developed a machine for making PCBs which removes unwanted copper by machining rather than by chemicals. The machine resembles an engraving machine and the location of machining is fixed with a light pencil that moves over the circuit model. This model of circuit need not be an artwork as in the case of chemical process; the designer's circuit drawing on a graph sheet to scale is sufficient. The machine in addition to preparing the circuit board also drills holes in the board, thereby reducing the cost of templates etc for medium runs.

Large scale production of boards is accomplished by a bigger machine in which the whole processing can be programmed and fed via tape. The taped programme controls the sequence and six boards can be prepared at one time. Programming is a simple thing—one just goes over the model in the sequence in which the operations are done and the recorder records the operations.

Contact: Precision Electronic Components Mfg Co, 1-1-60/2 Iftekar Mansion Compound, Musheerabad Road, Hyderabad 500020.

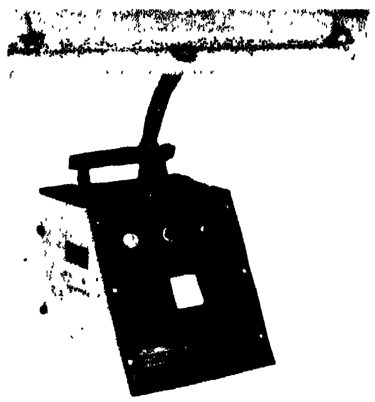


EMERGENCY TABLE LAMP

Hi-lite solidstate protable emergency light functions as a handy desk lamp when there is no power failure. But when a power failure occurs it switches over from mains to batteries automatically.

Equipped with indicator lamps for mains supply, tube fault and low battery voltage, it doesn't need to be separately charged as it charges itself continuously while in operation on mains. It has no starters or ballasts, yet emits a flicker-free light from a 30.4cm, 10-watt fluorescent tube.

Contact: Home Machines Pvt Ltd, 9/46 Industrial Area, Kirti Nagar, New Delhi 110015.



SILICON RECTIFIER BRIDGES

Usha Rectifier introduces a new range of Compacts' (silicon rectifier bridges) for single phase, three phase and similar other circuitry, ranging from 5 amp DC to 150 amp DC and up to 1200 volt DC covering various output requirements.

The mounting arrangement is similar to that of the company's well established selenium stacks. The similar shape of the new compacts, and the fact that only one threaded rod is provided to hold the entire stack, makes the mounting very easy for the equipment manufacturers.

Contact: Usha Rectifier Corporation (India) Limited, 12/1 Delhi Mathura Road, Faridabad 121003.

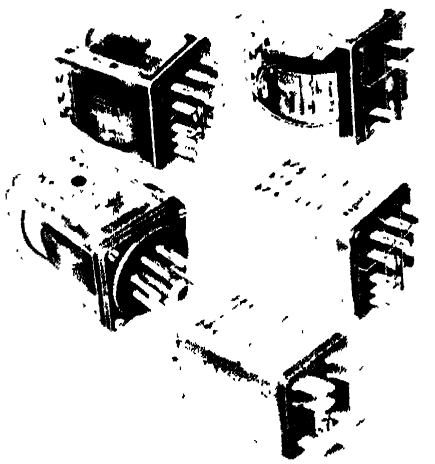
HEAT SINK COMPOUND

Afcoset electrically and thermally conductive heat sink compound type

ETC-01, not only reduces the high thermal impedance but also reduces the high electrical impedance due to unavoidable air gaps existing between the mating surface of the semiconductor and the heat sink. The grease like compound fills the air gaps and is applied to the base and the mounting studs of power diodes, thyristors/ silicon controlled rectifiers and other power semiconductors. It is available in 35 gm plastic containers.
Contact: Afco Limited, Plot No. 2, Kanjur Village Road, Kanjur Marg (East), Bombay 400078.

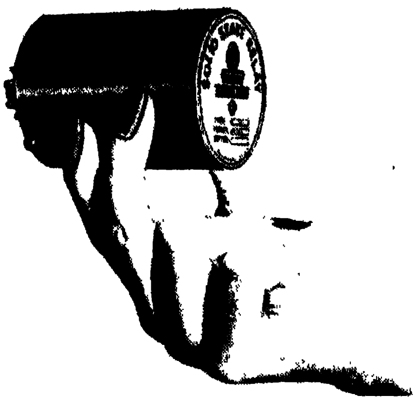
ELECTROMAGNETIC RELAYS

Eagleman electromagnetic relays provide reliable and durable switching systems for AC and DC applications in a large series of mounting styles and contact arrangements. The relays are available with up to 6 amp contact rating, 3 PDT points, in clear or milky or polystyrene, polycarbonate or polypropelene plastics or metal covers, and with 25 amps contact rating, SPST-NO, SPST-NC or SPDT contacts in metal cover, in solderable and clip-on terminal styles. Also available in 8-pin octal plug or 11-pin plug base. The overall dimensions of 25 amp relays are 29 x 33 x 68 mm only and these are enclosed in aluminium cans which provide excellent heat dissipation for high current performance.
Contact: Eagleman Enterprises, 3/19-A Kirti Nagar Industrial Area, New Delhi 110015.



SOLIDSTATE RELAYS

Advani-Oerlikon now offers a wide range of solidstate relays. These relays, type SR-2500, have 230 voltage switching and employ triac output circuit. Modular in construction, the units are of plug-in design. The devices are transformer coupled to isolate the low level DC controls to high voltage AC loads. The interphase between the two (input to output) is isolated to (1.5 kV) AC. Solidstate relays are designed for input voltages between 3 and 24 volts DC, for switching up to 230 volts AC at 5 amp.
Contact: Advani-Oerlikon Limited, Electronics Division, Akurdi Village, Chinchwad, Pune 411019.

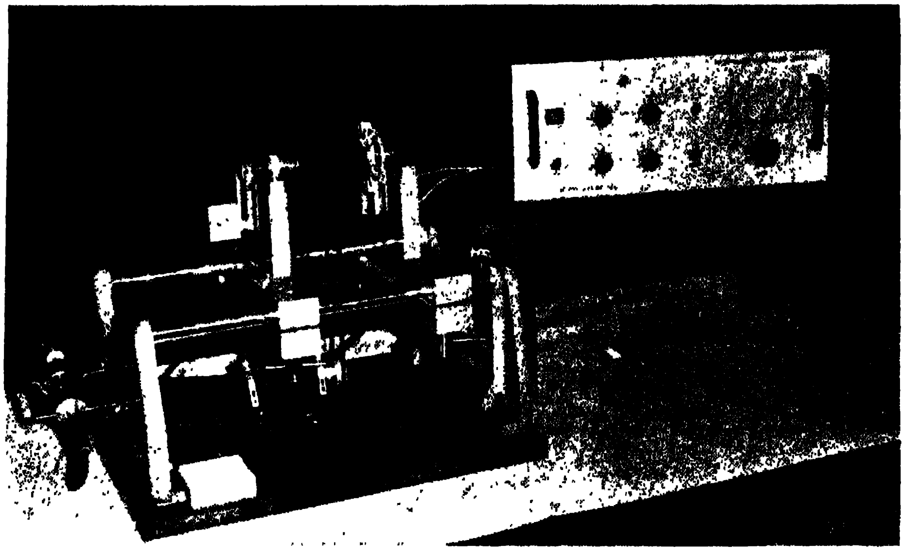


BALANCING EQUIPMENT

Dynamic balancing equipment is now being made by ACD Machine Control Company.

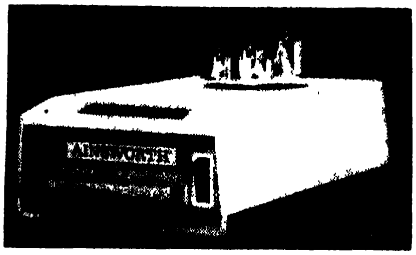
Unbalance in rotating bodies can arise from manufacturing tolerance in machining or from variations in the density of the material in castings or laminations. Such unbalance causes excessive vibrations in operation and also wears off the bearings with the consequent reduction in useful operational life of the machine.

The method used to eliminate unbalance is by the addition or removal of material in the position which completely counteracts the original unbalance. The function of the dynamic balancing equipment is to determine the relative amount and location of the corrections necessary to achieve balance.
Contact: ACD Machine Control Co (P) Ltd, E/6 Udyog Sadan-2, MIDC, Bombay 400093.



ELECTRONIC BALANCES

Compact and light weight, the Ainsworth top loading balances are designed to fit in a briefcase. Available in 20gm, 200gm and 2kg capacities and sensitivites of 0.001 gm. 0.01 gm and 0.1 gm respectively, these offer 4, 5 or 6-digit LED displays and eliminate the



errors inherent in vernier interpolation.

Special versions for weighing diamonds with carats and gold are also available. A special model with a battery pack is available for field use; both the balance and the battery can be carried in a briefcase. Also available are a number of micro, semi-micro, analytical and precision balances.

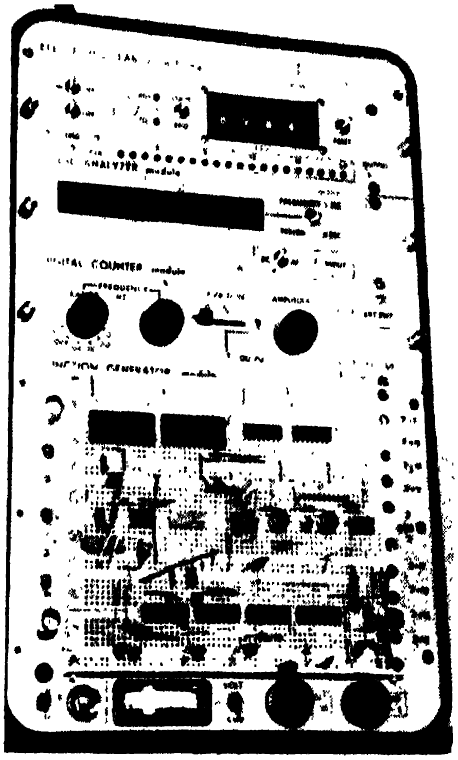
The balances can be imported by universities, research institutions, hospitals etc without a licence under the new policy.

Contact: Marsap Services, 501 Janmabhoomi Chambers, W H Marg, Bombay 400038.

MINI LAB

Networks Model 5D3 is claimed to meet the requirements of all those engaged in circuit design and development and also of advanced electronic labs in education.

All power supplies needed are built-in and NM 64 universal microboards are mounted on the panel of the mainframe. The mainframe accepts three plug-in modules at a time. Modular plug-in test and measurement instruments include frequency counter, DVM, logic analyser function generator and TTL pulse generator. Depending on the need of the hour, the right combination of instruments can be plugged-in, the circuit assembled on the microboards and powered by the built-in power supplies to speed up circuit testing.



Inherent advantages of 5D3 include low cost per function, compact size and minimisation of wiring distances.

Contact: Networks Pvt Ltd, 113/121 Swaroop Nagar, Kanpur 208002.

STOPWATCH MICROCIRCUIT

Intersil recently added a second device to its rapidly expanding series of single chip CMOS stopwatch circuits. The new ICM7205 is a fully integrated single chip microcircuit containing all the necessary circuitry for a two-function stopwatch. It includes on-chip an oscillator, frequency divider chain, multiplexer, decoder and output drivers, allowing it to interface directly with any fully multiplexed six digit/seven segment common cathode LED display.

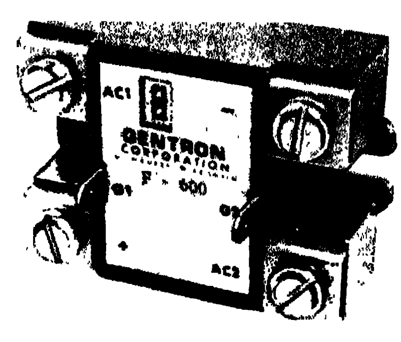
The only additional components needed for a complete stopwatch are a 3.2768 MHz quartz crystal, a display, three SPST switches, a trimming capacitor, three AA batteries and an on-off switch. For use as a two-function stop watch, it would also require one additional switch.

A low battery indicator located on chip comes on to indicate the approach of minimum operating voltage. To conserve battery life, the circuit features digit blanking on seconds and minutes. The circuit is fully protected against static charge. No special handling precautions are required.

Contact: Zenith Electronics, 54? Panchratna, Mama Parmanand Marg, Bombay 400004.

SCR BRIDGE CIRCUITS

Gentron Corporation recently announced that it has perfected a technique which "builds-in" a firing circuit in SCR bridge circuits designated as the F600 Series.



All SCR Bridge circuits normally require a separate circuit to fire SCRs. This new option includes the firing circuit with the power section. The unit is the same size as the one manufactured without the firing circuit, a feature important where small size is required.

Additional advantages include reduction of cross-talk, cost reduction, and increased reliability. Optical isolation and optical indicators can be used for special requirements.

Contact: Gentron Corporation, Custom Engineering Division, 6667 North Sidney Place, Milwaukee, Wisconsin 53209, USA.

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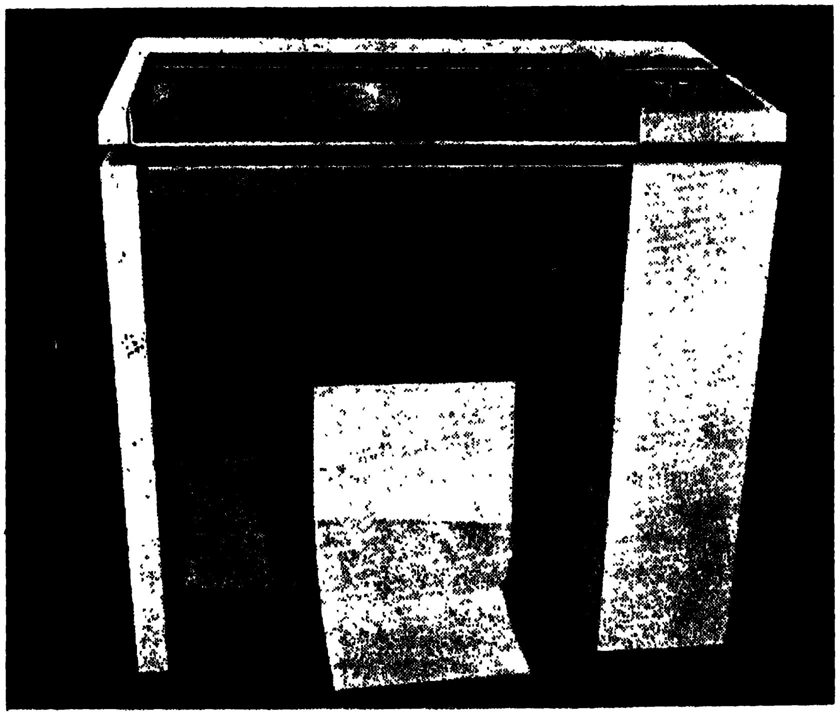

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FACTS & FIGURES

Licences & Letters of Intent

The following licences and letters of intent have been issued to electronics firms under the Industries (Development and Regulation) Act, 1951 during the months of January and February 1978.

Name & Address of the applicant and location of the undertaking (1)	*Date & type of licence (2)*	*Article (3)*	*Quantity per annum (4)*
LICENCES			
Keltron Counters Ltd, Keltron House, Trivandrum 695001. (Trivandrum-Kerala)	13.1.78 (NA)	1. Digital programme timers 2. Electronic time movements	5000 nos. 5000 nos.
Power Systems and Projects Pvt Ltd, System House, Palghat 678007. (Palghat-Kerala)	16.1.78 (NU)	1. Precision impedance bridge (accuracy better than 0.5%) 2. High frequency bandwidth oscilloscope (more than 50MHz). 3. Precision power supply (resolution better than 0.002%) 4. Selective level meters 5. Strip chart recorders and X-Y recorders. 6. Digital frequency counters 7. Digital multimeters (with auto and remote range selection facility) 8. Sweep generators to cover upto VHF/UHF microwave ranges	50 nos. 100 nos. 200 nos. 50 nos. 100 nos. 100 nos. 100 nos. 50 nos.
Tata Engineering & Locomotive Co Ltd, 'Bombay House', 24 Homi Mody Street, Fort, Bombay 400023. (Pune-Maharashtra)	31.1.78 (NA)	Printed circuit motors up to 2.2 kW ratings	150 nos.
J.V. Electronics Ltd, 808-9 Meghdoot, 94 Nehru Place, New Delhi 110024. (Faridabad-Haryana)	17.1.78 (SE)	1. Silvered mica plates, sections & components 2. Silvered mica capacitors	From 200 million nos. to 350 million nos. (after expn) 15 million nos.
Devidayal Electronics & Wires Ltd, Gupta Mills Estate, Reay Road, Bombay 400010. (Bangalore-Karnataka)	18.1.78 (NA)	1. Cassette/cartridge drives 2. Alphanumeric display terminals	100 nos. 100 nos.
Universal Electrics Ltd, 9/1 R.N. Mukherjee Road, Calcutta 700001. (24-Parganas—W.B.)	27.2.78 (SE)	Protective relays	23,750 nos. 30,000 nos. (after expansion)
LETTERS OF INTENT			
Damodar Ratha, 3-A Bel Air, 9-Pali Hills, Bombay 400050. (SEEPZ, Bombay-Maharashtra)	5.1.78 (NU)	Polyester capacitors, Polystyrence capacitors, Metallised film capacitors, Inductors	20 million nos.
Siemens India Ltd, 134-A Dr A.B. Road, Bombay 400018. (Maharashtra)	17.1.78 (NA)	Electronic measurand converters for temperature, speed, current, voltage, resistance, frequency, power factor, active & reactive power, pressure, differential pressure, flow, level etc.	300 nos.
C.V. Ram, Alagappa Cheettiar, 91 State Housing Board Scheme, Kotturpuram, Madras 600085. (Tamil Nadu)	17.1.78 (NU)	TV receivers	100,000 pcs.
Orbitron Electronics, 7 Parvati Indl Estate, New Sun Mill Compound, Lower Parel, Bombay 400013. (Nasik-Maharashtra)	18.2.78 (NA)	1. Diodes (1 amp & above upto and including 30 amps) 2. Triacs/Diacs 3. Power transistors 4. SCR's (Less than 30 amps)	200,000 nos. 500,000 nos. 200,000 nos. 200,000 nos.

CHANGES & CANCELLATIONS

(This information pertains to particular licences only)

Licences/Registration Certificates Revoked during January & February 1978

Name of the undertaking	*Items of manufacture*	*Date of the licence & location*
Iscomed Industries Pvt Ltd, Bombay	Electromedical & surgical equipments & appliances (Revoked)	27.6.75 (Maharashtra)
Indian Electronics, Bombay	Electronic components etc (Revoked)	24.3.61 (Gujarat)
Apar Pvt Ltd, New Delhi	Radio receivers (Revoked)	22.8.68 (Gujarat)
Kundan Sons (India) Pvt Ltd, New Delhi	Electro-medical equipments (Revoked)	3.4.73 (Haryana)

Letters of Intent Revoked, Cancelled & Lapsed during January & February 1978

Name of the undertaking & location	*Items of manufacture*	*Date of LI & location*
Dass Hitachi Ltd, New Delhi	Electronic components (Lapsed)	22.8.69 (U.P.)
Philips India Ltd, Bombay	Voltage level indicators (Cancelled)	19.5.76 (Maharashtra)
Andhra Pradesh Industrial Development Corporation, Hyderabad	Printed circuit boards (Lapsed)	6/9.8.74 (A.P.)
Anand Mohan Agarwala, Nagpur	Data entry systems and cassettes/cartridges drive (Revoked)	26.3.76 (Maharashtra)
Punjab State Electronics Development and Production Corpn Ltd, Chandigarh (Punjab)	Quartz blanks and quartz crystal units (cancelled)	29.1.77 (Punjab)
Debikay Electronics, Thana (West Bengal)	DC motors up to 200 kW (Lapsed)	14.10 74 (W. Bengal)
Bhadkal Electronics (P) Ltd, New Delhi (Haryana)	Electronics speed control (Revoked)	7.7.75 (Haryana)

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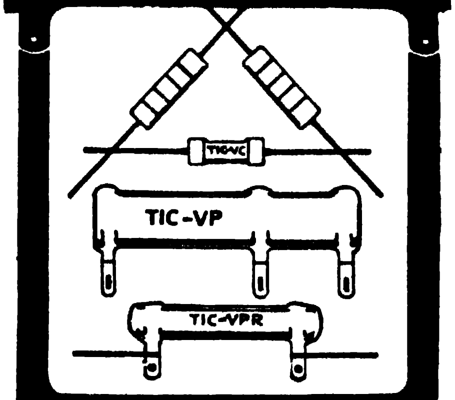

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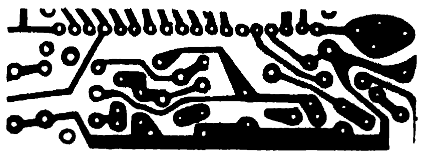

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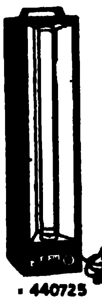

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455	3.15	7.2	15
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Modulation Frequency:
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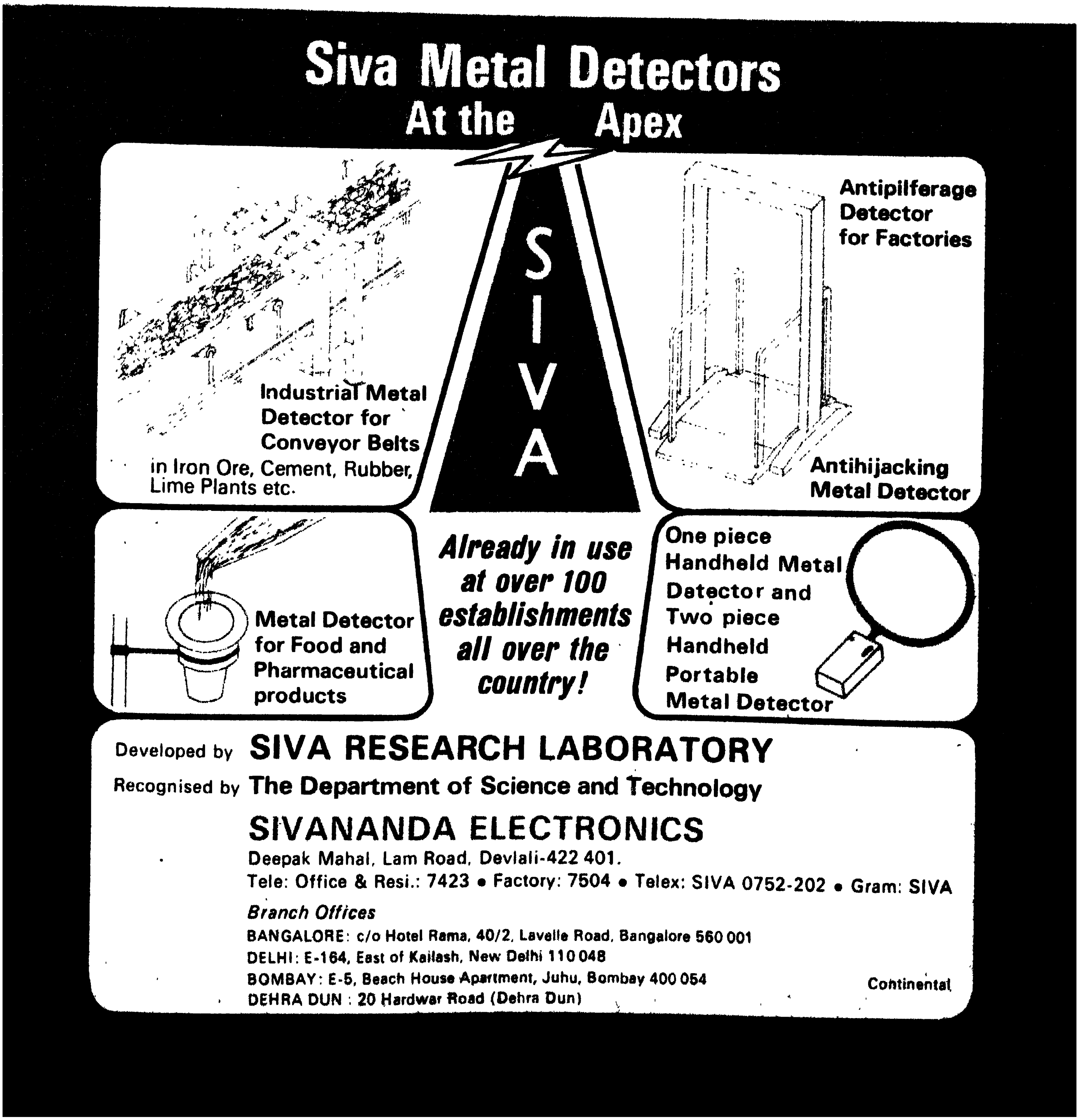

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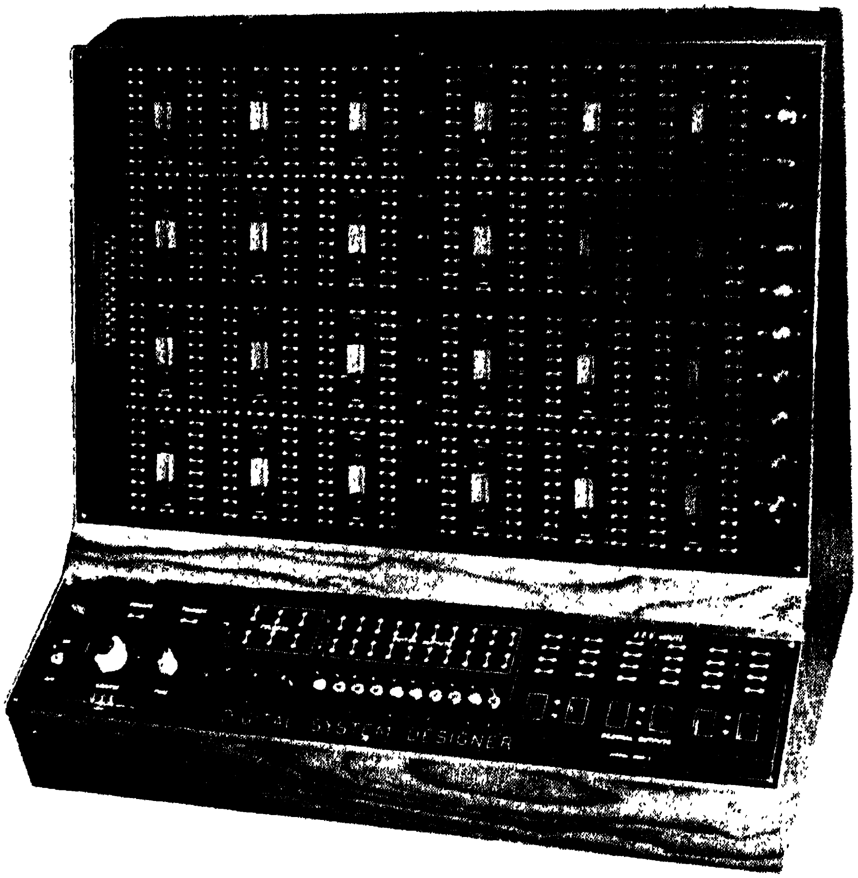

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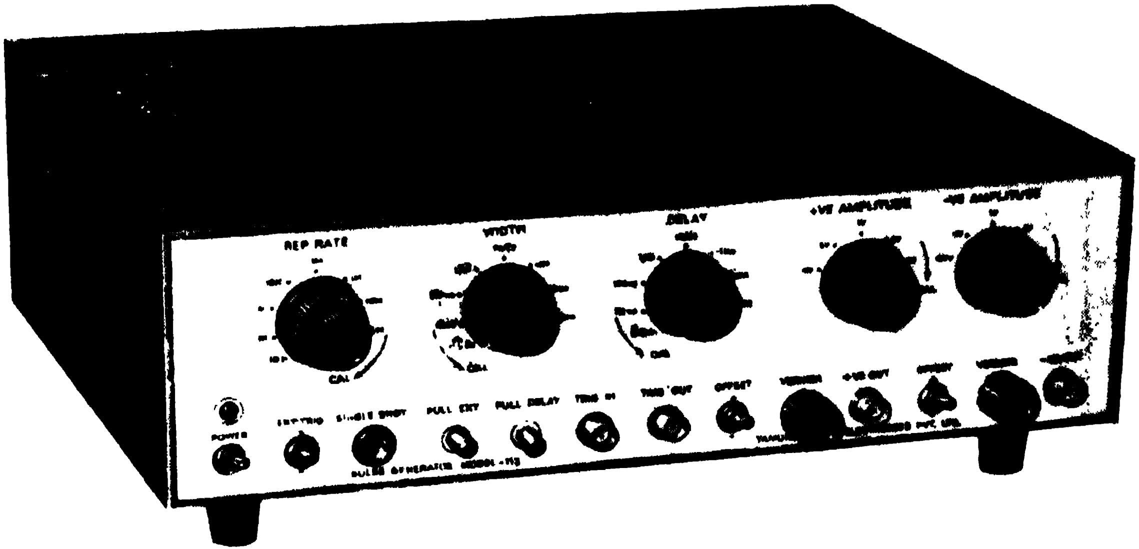

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		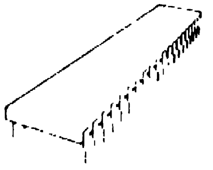	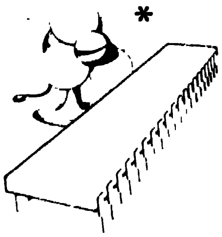	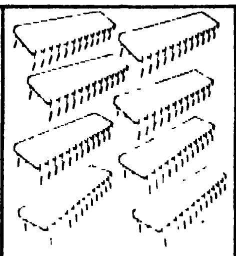	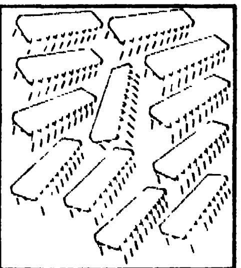
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ORGANIZATION		8 X 8	8 x 8	2 X 4	4 X 4
TYPICAL SPEED		100 NS	130 NS	75 NS	75 NS
POWER		1W	1.8 W	5W	5.4W
PACKAGE		40-PIN	40-PIN	24-PIN	20-PIN
NUMBER OF PACKAGES		1	1	8	12
TECHNIQUE		COMBINATORIAL (BOOTH)	COMBINATORIAL	COMBINATORIAL (BOOTH)	COMBINATORIAL (WALLACE)
ROUNDING		YES	YES	NO	NO
MFG. PROCESS		LS/TTL	TRIPLE DIFFUSION	S/TTL	S/TTL
SECOND SOURCE		YES	NO	YES	NO
DATA REP.		SIGNED and UNSIGNED	SIGNED ONLY	SIGNED ONLY	UNSIGNED ONLY
TOTAL $	**MIL**	110	115	210	≈140
At 100 UP quantity	**COM**	64	70 (Fan not included)	124	68

*300 fpm cooling required

(Second sourcing from ITT Semiconductor.)

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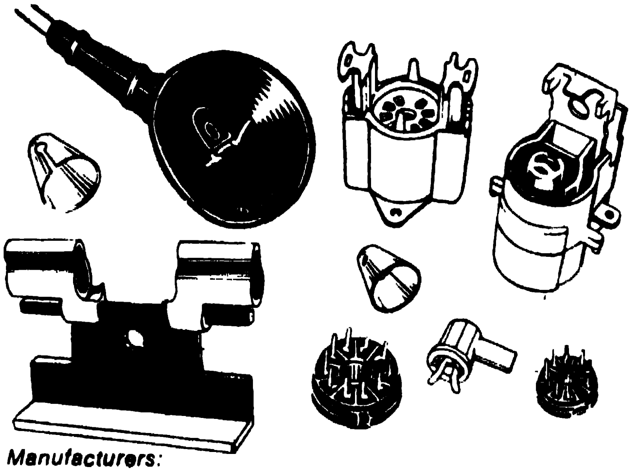

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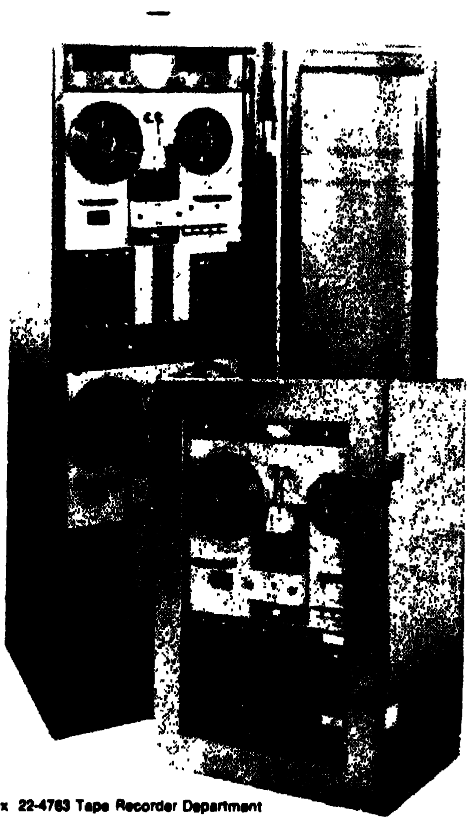

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EDITORIAL

Technology: To Import Or Not To Import

In August 1969, this journal had published a special supplement on the above - mentioned subject.

At that time, the question facing the electronics industry of this country was whether to allow the import of technology in regard to the manufacture of TV sets or not.

After discussing the pros and cons of the problem, this journal had come to the conclusion that indigenous knowhow needed to be encouraged and that the cost of foreign collaborations, rising technical fees, royalty remittances as well as dividend remittances were a formidable burden for this young industry.

Today, the same problem has cropped up in regard to the computer industry in this country. The rigorous application of the Foreign Exchange Regulation Act (FERA) has resulted in the exit of the International Business Machines (IBM). The vacuum thus created will need to be filled either by indigenous companies, both in the public and private sectors, or by foreign companies which have agreed to abide by the FERA.

Among the indigenous companies, Electronics Corporation of India Limited (ECIL) is the one which has given a splendid account of its performance during the past decade. In the field of computers, it has relied all along upon indigenous knowhow and has religiously avoided entering into any collaboration with a foreign company.

International Computers Limited (ICL) is a British computer company which has been in this country under one name or the other even for a longer period than the IBM. This company has agreed to dilute its equity capital up to 40 per cent, implying that 60 per cent of its equity capital will be in Indian hands. Because of its association with the British parent company, it has an overwhelming advantage over its competitors in India, because it can draw upon the large fund of technical knowhow which is available in London.

The progress that the computer industry in Europe and the USA has made during the past decade is phenomenal. Massive sums have been invested in order to produce faster, more compact and cheaper computers. In the wake of the "Man on the Moon" project in the USA, a considerable amount of technical knowhow has been released by the American government for civilian use.

The question which stares companies such as the ECIL in the face is, whether to continue with its policy of relying on indigenous knowhow or to search the American and European markets for technical knowhow which may enable them to compete with ICL and similar category of companies.

Let it not be forgotten that the ECIL has a proud record of achievement, having marketed no less than one hundred computers in this country. If it wants to compete with other companies, it has no option but to go out and buy the latest technology in the markets of the world. It will not be wise for it to try to discover what has already been discovered abroad for two reasons. First, it will entail stupendous expenditure in terms of money. Second, the time lag that will result will become a hindrance in its onward march.

This journal sincerely believes that the ECIL and similar other companies should not stand on ceremony in this regard. We have all along appreciated ECIL's continued reliance on indigenous knowhow because that posed a challenge to our technicians who rose to the occasion and, in the process, gained tremendous amount of self - reliance and confidence. But at this juncture, keeping in view the long - term interests of the ECIL and other companies, both in the public and private sectors, it is necessary to give competition to those who can draw upon the fund of technical knowhow available abroad.

In short, this is the time not to stick to old slogans which have lost their meaning in a fast changing world. In 1969, the paucity of foreign exchange was a big constraint, but it does not exist today. The government should be too willing to assist those who wish to be competitive and efficient, even if it costs the country a few millions of dollars.

In technical warfare, it is the resilient units which can aim at ultimate success. Those who stick to old values, even in changed environment, may find it difficult to fight against the new challenges.

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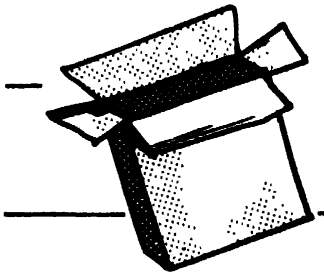


WHAT'S NEW

In India ...

Electronics Industry's Production Exceeds Rs 5000 million

In our issue for the month of January 1978 we had indicated in the editorial entitled "1977: Leap Forward in Electronics Industry" that the output of the electronics industry in this country was estimated to have crossed the Rs 5000 million mark in 1977. The annual report of the Department of Electronics for 1977-78, released recently to the press, has confirmed the estimate made by this journal. The report has stated that the total production of electronic items in this country increased from Rs 4100 million in 1976 to Rs 5085 million in 1977. This meant a rise of 24 per cent in financial terms on the basis of current prices. In this way, the electronics industry had exceeded the targets for production laid down for 1976 and 1977 in the perspective report prepared by the Electronics Commission.

In the sphere of exports, the industry recorded a rise of 36 per cent in 1977 over 1976. The total value of exports was of the order of Rs 368.7 million. The role of consumer electronics in exports is steadily declining while that of others, especially defence and aerospace, followed by components, computer software etc, has been on the increase. Santacruz Electronics Export Processing Zone scaled a new height in exports at Rs 41.1 million.

In the field of computers, the exit of IBM and the willingness of International Computers Limited (ICL) to dilute its equity capital has introduced a new element in this fast changing scene. Tata Burroughs is a fifty-fifty joint venture which is expected largely to export its products. Only a small part of its output will be available for the Indian market on the authority of the Department of Electronics.

TV Production in 1977 Increased by 70%

The production of TV receivers in 1977 increased to 238,833 sets from 143,777 set in 1976, according to the annual report of the Department of Electronics.

The spurt in production is believed to be partly due to introduction of economy models (enjoying concessional excise) and due to commissioning of new TV centres at Jaipur, Mussorie, Gulbarga and Hyderabad.

Though the production of TV sets in physical terms increased by 70 per cent, the increase in monetary terms was only 50 per cent, since the average ex-factory value of TV sets decreased further during 1977. Production in the small - scale sector constituted 75 per cent of the total production during the year.

Import Policy: Confusion Worse Confounded

The import policy for the current year, details of which will be found elsewhere in this issue, has baffled the exporters of electronics goods.

While the daily newspapers have praised the new policy sky-high for its liberalisation as well as rationalisation, the exporters of electronics products have failed to find simple answers to some of the questions such as:

(i) Will the duty drawback be made available to exporters, as hitherto?

(ii) What is the present status of cash aid for exports of electronics products?

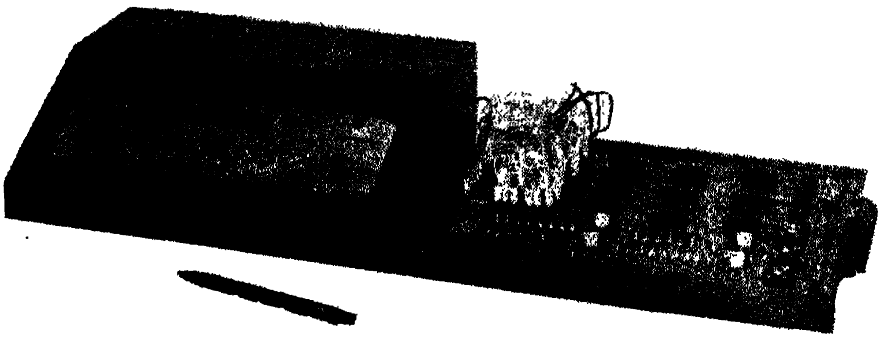
(iii) And what about the replenishment licences?

The first result of the absence of clarity on these questions is the stoppage of exports, and the hesitation of exporters to send quotations to prospective importers in other countries.

Surely, it is for the commerce minister, Mr Mohan Dharia, to ask the bureaucrats in the ministry to throw light at once on questions raised by the electronics industry.

Electronics System Design Kit

The electronics system design kit developed by the Centre for Electronics Design Technology, Bangalore, is an excellent tool for engineers and students involved in the design and development of electronic circuits and equipment. Any circuit or system can be easily and quickly set up without soldering. Indigenous 1 mm patchcords and sockets are used for fast



and reliable interconnections.

The kit essentially consists of a main unit and a design board. The main unit contains a 5V/2A and a ± 12V/0.3A power supply (all short-circuit protected), a clock generator running at 1Hz/1kHz/1MHz, a 3-digit display (7-segment), 8 TTL logic level switches and a bounce-free reset button. The design board is plugged in via a 44-pin connector to the main unit and is basically a PCB fitted with DIP-16, TO-5 (12-pin) and transistor sockets.

The kit also contains presets, trim capacitors and solder terminals for resistors and other components. The outputs from the main unit are available on sockets on the design board along with the inputs for the display. For more complex circuits, e.g. with more than 12 ICs of DIP-type, additional design boards can be plugged on to the main unit from the right side.

The kit is available for commercial exploitation.

Ram Vepa Appointed New DC (SSI)

Dr Ram K. Vepa, deputy chairman and managing director, Andhra Pradesh Industrial Development Corporation, Hyderabad, has been appointed as the development commissioner, Small Scale Industries of India. He is thus back in New Delhi where he was formerly technical director (licensing) in the Department of Electronics.

Department of Space Report

The annual report of the Department of Space for 1977-78 released recently showed that the following five main programmes have progressed in the area of space application:

1. Satellite Telecommunications Experiments Project (STEP)
2. Ariane Passenger Payload Experiment (APPLE)
3. Satellite for Earth Observations (SEO)
4. Indian National Satellite (INSAT) programme
5. Development Work in Remote Sensing.

During the year under report, government approved the INSAT system. This system would be established through procurement from abroad two satellites, to be launched into a geo-synchronous orbit in early 1981. If the importance of a project is measured by the amount of expenditure incurred in 1977-78, then the following table will be found instructive:

	Project	*Expenditure in 1977-78* (Rs million)
(a)	Vikram Sarabhai Space Centre, Trivandrum (VSSC)	181.7
(b)	Shar Centre, Sriharikota (SHAR)	109.9
(c)	ISRO Satellite Centre (ISAC), Bangalore	69.0
(d)	Space Application Centre, Ahmedabad	39.5
(e)	Physical Research Laboratory (PRL) Ahmedabad	13.7
(f)	Central Management	24.8

The report states that confidence in a successful launch of the Satellite Launch Vehicle (SLV) by mid-1979 has increased following the successful flight in October last year of ISRO's first guided rocket that followed a pre-programmed flight path.

EEC and Indian Computer Software

A 22-member delegation from the European Economic Community (EEC) was in this country in the first week of April for consultations with the Department of Electronics and the computer consultancy services for increased utilisation and export of computer software to EEC countries.

The leader of the delegation was Mr S. Bir—director-general for industrial development of the Commission of European Communities. The delegation also included representatives of leading computer manufacturers in six countries.

Beside discussing with Prof. M.G.K. Menon, the delegation visited software consultancy houses to assess their capabilities in preparing programmes.

It is well-known now that India has abundant capacity of trained manpower which can be used profitably for supplying software for indigenous use as well as for exports. It has been estimated that no less than 60 software groups are operating in different parts of the country. They can be made to play an increased role in the export of computer software.

ELCINA's Views on the Budget

Mr H.M. Patel's budget proposals for 1978-79 have angered many people, including trade and industry associations, though for a wide variety of reasons. Some of them are annoyed because of the enhancement in tax burdens. There are others who are unhappy because they have not been given the relief which they had been anticipating. ELCINA belongs to the latter category.

ELCINA has been demanding for some time past increased rates of depreciation for the machinery used in the manufacture of electronic components. In support of its contention, it cites an authoratative report—a report prepared by the IPAG of the Electronics Commission which was released in August last year and which had suggested the raising of depreciation rates ranging between 20 per cent and 40 per cent depending on the process of manufacture. Obviously, the noises made by ELCINA and Electronics Commission are too feeble. They need a louder drum whose beat may reach the corridors of the ministry of finance. Or is it that in the government of India's right hand hardly knows what the left hand is doing?

Again, ELCINA was given to understand that the electronics components industry could look forward to relief on import duties on raw materials. It had to face disappointment on this score as well. While the import duty on capital equipment for leather and garments industries has been reduced to 25 per cent, ELCINA has drawn a blank in this regard. In Biblical language, the finance minister has rewarded the favourite sons because of their good performance on the export front. Perhaps the electronics industry will have to show as good results in exports as the leather and garments industries have demonstrated in order to earn a favourable treatment in this regard. ELCINA is right when it states that the present heavy import duties make it impossible to compete in the world markets. It says that the industry is already running a "hurdles race" hurdles imposed by the government. To ask the industry to cross them in order to earn the much wanted relief is like saying: "To them shall be given who have enough and need not. But those who need, shall not get."

I.K. Gupta Retires From ITI

Mr I.K. Gupta, chairman and managing director of Indian Telephone Industries (ITI) Limited has retired after serving the P&T department for nearly three decades. He was in the ITI since last six years. In his place, Mr Thomas Kora is looking after the ITI as acting managing director.

And Abroad ...

"Japanese Spies" in Silicon Valley

The Japanese have made it their national goal to leapfrog the United States in semiconductor technology and thus gain dominance of the world's computer and electronics markets. This view has been expressed by Mr Gene Bylinsky in an article published in *Fortune* dated February 27, 1978. (Fortune is a fortnightly published in the USA by the Time-Life publisher). The title of the article is: The Japanese Spies in Silicon Valley.

And to attain their objective, the Japanese will not stop to stoop; they will do anything; they will lie, steal, and cheat. Mr Robert N. Noyce, chairman of Intel Corp., a pioneer firm in the semiconductors industry, is reported to have told Mr Bylinsky that the Japanese "are out to slit our throats and we'd better recognise that and do something about it."

The American executives feel that so far the Japanese have basically been skilled copiers and manufacturers, no innovators. But that may change soon. And a Japanese company has already promised to be first with a production quality 64k memory chip, the next step in memory complexity.

An interesting revelation made in the article is about the secrecy of technical knowhow maintained by the Japanese companies. When an Amercian industrialist wanted to see a Japanese electronics unit, he was told: "The operations manager is out today and we have a number of matters to discuss. Oh, our time is all gone;" and all that he could see was a lot of conference rooms. Says Mr Bylinsky: "We can't live in a world where the rules are different for the opposing teams in the same game."

Electronic Age Touches Taxi Meters

With Canadian-made electronic taximeters now on the market, taxicabs, too, can enter the electronic age. One such product, manufactured by Centrodyne Corporation of Montreal, Quebec, is the 'Silent 500' Taximeter. A fully solidstate digital instrument, it is designed to replace the mechanical or clockwork meters currently installed in taxicabs.

The Silent 500, resembling a mini calculator, features computer accuracy to yield exact fares. With five digits for regular fares and three for extras, the unit will, at the user's option, count in either 5 or 10-cent increments. The meter switches automatically from mileage rates to time rates—depending on the speed which can be pre-set and is programmable. At the push of a button, the operator can also go on mileage only rates.

Prior to the introduction of electronic taximeters, rate changes required the replacement and adjustment of gear wheels and gear ratios. Now, with the electronic device, one simply swaps out a memory component.

The Silent 500 is also provided with an internal standby battery so that, should the vehicle's electric system fail, the meter will still retain all pertinent statistical information! Being fully electronic, there are no noisy and expensive parts to wear out. Easy to instal, the unit is light, compact and features rounded corners as an additional safety feature. Because of its high degree of accuracy, the Silent 500 ensures the driver receives his exact legal fare. There is also an interlock to prevent the driver from clearing the meter by mistake.

Centrodyne Corporation introduced the Silent 500 Taximeter in October 1976, and wishes to export to international markets.

International Communication

About 70 per cent of all intercontinental telephone calls are already conducted via communication satellites, which also relay telex messages and radio and TV broadcasts. Seven satallites of the generation Intelsat IV and IVa now form a path for intercontinental communications traffic right round the world. Over 140 ground stations have been installed on all continents to beam the messages to the satellites and, at the receiving end, to pick up the weak radio signals transmitted by the satellite from a height of 36,000 km.

The ninth ground station to be built by Siemens, W. Germany for the Intelsat network is currently being installed in the Netherlands. The diameter of the antenna reflector is 32 metres.

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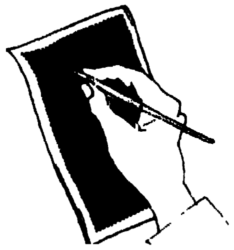

LETTERS

TV CONTROVERSY

Mr A.S. Sharma's article on Indian TV Industry in the December, 1977 issue was interesting, but at best controversial if not positively patisan. He appears to have chosen to voice the opinions of a few large - scale manufacturers, but has not given any weight to the feelings of many small - scale manufacturers who have contributed significantly to the healthy development of the industry.

Mr Sharma's statement that "most of the low-priced sets are hybrid, but practically all units produce solidstate receivers as well" can be disputed. Even today a majority of manufacturers produce only hybrid sets. Until 1975, when our company started manufacturing a 51cm solidstate receiver, the only solidstate receiver produced in India was 'EC TV.' There were a few sporadic attempts to produce solidstate receivers earlier, but these were all short-lived.

By 1976 four manufactuters had put on the market 30cm and 35cm solidstate receivers,but the market for such small sets was limited. In 1977 about four or five other manufacturers started manufacturing 51cm solidstate receivers. The total number of manufacturers today marketing solidstate receivers of all types does not exceed seven or eight out of nearly 55 to 60 active television set manufacturers.

The author's statement that "Hybrid sets use solidstate devices as well as vacuum tubes and make the best use of the present state of art" is also misleading. Hybrid sets were developed at a time when high - power and high - voltage transistors were not available, and at that time they made the best of a bad bargain. But it was clear that hybrid sets did not solve the basic problems of television. Since valves continued to be used in the high - power stages, there were hardly any reduction of power consumption or heat dissipation as compared to all - valve sets. The reliability of a set can be significantly improved if the set runs cooler, as a solid-state set does, particularly in a hot country like ours. However, there was no scope for such improved reliability in the hybrid set.

The solidstate set has many other advantages if well designed, such as improved quality and performance due to the use of transformerless complimentary or quasi - complimentary sound and vertical output stages, the provision of built - in automatic voltage regulators, and the possibility of instant picture and sound — as introduced in 'Eastermann' sets for the first time in India.

As regards availability of components, it may be stated that although in the beginning the import content of solidstate receivers was higher, practically all components are now being made indigenously, except the EHT rectifier which is a low-cost item.

The only justification for a hybrid receiver at present is its lower cost, though all solidstate portable TVs are already cheaper than hybrid sets.

Mr Sharma's objections to the use of ICs cannot also be upheld. If ICs were really more expensive than equivalant discrete circuits, there could be little economic justification in using them. The fact is that even if they are imported their cost is lower, if we take into account the lower assembly cost. Moreover, most of the ICs for TV are now being manufactured in India, with still further cost reductions.

Besides, ICs are capable of giving a better performance than equivalent discrete circuits. For instance, in the Siemens type TBA120S sound IC which we use, the high gain in the limiter section given better AM rejection than in the simple ratio detector. Also, the coincidence demodulation used in this IC gives less distortion and better performance than the ratio detector.

The Siemens TBA440 IC which we use for video IF amplification is provided with synchronous detection which gives a more faithful tonal reproduction and makes it less susceptible to phase errors due to vestigial side - band transmission. The higher gain in the AGC section of this IC also makes the gated AGC system more perfect.

The I.T.T. Intermetall TBA940 IC which we use in the sync circuit allows more perfect horizontal and vertical synchronisation than in the case of discrete circuits. Lastly, as is known, the reliability of ICs is much more than that of equivalant discrete circuits.

Mr Sharma has singled out ECIL for reliability of their sets and says "Production at ECIL is backed by a competent design team." The fact is that our design team has been able to produce a receiver which is technologically more advanced, capable of giving better performance, and also intrinsically more reliable as less heat is developed due to the use of high - efficiency circuits like thyristor voltage regulator, elemination of wound components, use of a non - germanium circuitry, use of three ICs and provision of electronic over - voltage and over - current protection.

Mr Sharma has criticised the policy of the Department of Electronics and Electronics Commission in reserving the TV industry for the small - scale sector, and has pleaded for largescale production and vertical integration based on the experience of other countries. Whatever may be the situation in other countries, it must be stated that conditions in India are not exactly the same, and the authorities in our country had their own reasons for taking this unconventional step. We can only say that the small - scale TV industry has not let down the government or the country. They have fully justified the trust the authorities had placed in them.

Mr Sharma has waxed eloquent in

favour of Bharat Electronics in the field of semiconductor devices and of Philips in the field of passive components. However, at the time we started our research on solidstate receivers, BEL could not offer us any of the high - voltage and high - power silicon devices required. So we had to turn to the smaller units like Electronics and Computers for the video output transistor EC48A, CDIL for high - voltage transistor CIL622 and 2N3019, Semiconductors Ltd for the complimentary pair SK100 and SL100 and the thyristor SN104, and to Hind Rectifiers Ltd for the high-voltage and high - current diodes. We do not think the reliability of these devices is inferior to the few low - power transistors from BEL we are using.

Similarly, we could not obtain the high - voltage paper and mica capacitors from Philips and it is only the small - scale manufacturers like Elciar, Kemi and Pikon who came to our rescue and thereby, along with the active device makers mentioned, enabled us to achieve the maximum amount of import substitution in solidstate receivers in the country. Again, the reliability of their components is not inferior to the standard components of Philips.

S. BANERJEE
Technical Adviser, Eastermann TV,
Joyti Electronics, Calcutta

Mr Sharma's rejoinder will be published next month

PLEASE PUBLISH....

For the past two years I have read and enjoyed EFY. Above all, I have wired almost all of your circuits to the greatest of my delight. I will be happy if you will kindly publish the circuit diagram of a standard signal generator using semiconductors/ valves.

SURYA KANTHAN
New Delhi

☐ I would like you to publish the following:

1. The complete name and detailed information about the prominent radio, TV and other electronics institutions in India where one can have diploma and degree courses.
2. An article about the light emision diodes, including their construction, working and applications.
3. An audio amplifier circuit along with the constructional instructions using the ICs like CA3020 and CA3020A.
4. An article about the basic working of digital instruments.

S.K. GUPTA
Distt Bareilly

☐ I have been reading EFY for the last two years and have also built the electronic pocket calculator described in the Nov.'77 issue.

Now I would like to make a tape recorder. You are requested to publish a complete construction project at your earliest.

You are also requested to publish the approximate cost of components used in the projects.

A.K. MANWANI
New Delhi

EFY's New Advertisement Rates
(Effective: October 1978)

Black & White Ads	**Casual (Single)**	**6/Year**	**12/Year**
Full Page Inside	Rs 720	Rs 650	Rs 600
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Front Cover (4-colour)	Rs 3500	Rs 3350	Rs 3250
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1. 10% extra will be charged for a specific position for an ad to be published at an inside position, subject to its availability.
2. Full page bleed advertisements will also cost 10% extra.
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4. Business stipulations and other details are also available on request.

Contracts entered into up to August 1978 and would be honoured at the existing rates (effective since April 1977), for the duration of such contracts, up to a maximum period of 12 months from the first insertion.

Write today to: The Advertisement Manager
Electronics For You
303 Dohil Chambers, 46 Nehru Place,
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AUTONOMY FOR RADIO & TELEVISION

H.K.L. Arora and Sunder T. Vachani

After 50 years of broadcasting in India, we have 20 million radio sets in use in this country. Taking five persons per family, we have 100 million radio listeners out of a population of over 600 million. This works out to a meagre 16.6 per cent coverage in half a century.

According to the latest figures available. there were 3.54 million low-priced radio sets costing less than Rs 125 each and 13.5 million high-priced sets in use till the end of 1976. This shows that the price of a radio set cannot be the main reason for the slow growth of the radio industry in India.

The number of radio sets in villages, where 82 per cent of the population of this country lives, is rather small. If villagers had radio sets, they could have benefited from the flood/ cyclone warning broadcasts, amongh other things, and the losses from recent cyclone and floods in Orissa, Tamil Nadu and Andhra Pradesh could have been kept down. Year after year, villagers have to suffer because they cannot afford to buy radio sets which can warn them of the impending floods and cyclones.

In 1968, the National Council of Applied Economic Research compiled statistics on household incomes, savings and expenditure in rural and urban areas. According to this survey, in the urban areas 51.1 per cent of the households have monthly incomes in the Rs 1000-1300 range. In U.P. the urban population is 14 per cent, i.e. 13.1 million, and the corresponding number of households is 2.5 million. The number of households in the Rs 1000-1300 income group is 1.3 million (51.1 per cent of 2.5 million). The radio licence figure of 1.25 million in U.P. (1974) corresponds to the number of households. This confirms that there are very few radios in villages.

Prohibition is important. So is family planning. But in our view, education is more important than prohibition and family planning put together. If a person is educated, he is aware of the benefits of prohibition and family planning on his own. Self - realisation is much more beneficial than compulsion by law or "forced" persuasion. Here we quote from the West Bengal memorandum to the Finance Commission.

"The State Government considers that, in terms of priorities, the provision of free and universal school education should come ahead of the enforcement of prohibition. Besides, the more effective method of enforced prohibition is to educate the people and raise their living standards and general level of awareness; legislation can only have limited effect by itself."

The radio is the cheapest, the quickest and the easiest means of education and information as compared to any other mass media—the newspaper, the film or the limited education facilities available to cope with 70 per cent illiteracy and our population explosion. The phenomenal progress made by the USSR is largely due to the extensive use of radio and TV for education and information. Many other countries have similarly profited from the use of radio and TV. The Chanda Committee (1966) report had this to say:

"It is hardly necessary to elaborate the point that progress in other spheres of national activity, such as, family planning, health and hygiene, can be accelerated by the skilful use of radio and television. It is in this process of education and development that they must play, as elsewhere, a decisive role. By their imaginative use we can raise our social and economic life to new heights of endeavour and achievement."

The Verghese panel should have gone more into the basic failure of broadcasting in India instead of concentrating on the excesses of the emergency which have unfortunately led it into the wrong alley. It is a paradox that it was Mrs Indira Gandhi who, during her ministership of Information and Broadcasting, appointed the Chanda Committee which suggested an autonomus corporation for All India Radio.

The regional administrative radio conference on LF/MF, held in Geneva in 1975, decided the shape of LF/MF broadcasting network. It recommended for India 780 MW transmitters as against the existing number of about 100. Out of 780 transmitters, 280 have already been authorised. The authorised power range extends from 1 kW to 2000 kW. When fully utilised, the radiated power of MW transmitters will go up to 18,000 kW (day and night services) and 7000 kW (day time service only) from the present total of about 4500 kW only. This would ensure provision of four programmes simultaneously to every listener. This plan is still valid for 11 more years. At present, only 30 broadcasting centres in India are able to give more than one programme channel, the remaining 54 are only one-programme chanel stations.

For achieving about 90 per cent TV coverage in India, about 23 TV channels in the VHF and UHF bands and a total of 300 TV transmitters with effective radiated powers ranging from 5 kW to 1000 kW and antenna height of 150/175 metres will be required.

The communication satellite will be a great boon to the growth of radio and TV. The total expenditure on the expansion of radio alone, as mentioned above (without satellite), would be Rs 7000 million. How can an autonomous corporation mobilise such volume of funds? If the government provides these funds year after year under the rolling plans, it is too much to hope that there will be no government control or interference in spite of the safeguards provided by the panel. Therefore, the logical and practical course would be to set up a few corporations for radio and TV, as suggested by Mr Y.A. Fazalbhoy, namely:

1. Transmitting Corporation of India: This may be owned by the government or it may be a public corporation whose task would be to provide radio and TV transmitters and studios, and lease them on yearly contracts to Akashvani and Doordarshan and to independent radio and TV broadcasting corporations. This corporation will take over the present transmitters and studios of AIR and Doordarshan. For expansion, the money will be provided by the government of India. The maintenance of transmitters and studios will be from the lease money received from Akashvani, Doordarshan and independent broadcasting corporations.

2. Akashvani and Doordarshan may remain two separate organisations (turned into corporations) and they will broadcast/ telecast programmes for social welfare—education, information, news and views, programmes for schools and colleges, farmers and workers etc. The external services will be manned by Akashvani for which the government will pay. The income of these corporations will be from excise duties on radios and TVs, import duties on radio parts and, if absolutely necessary, from TV licences as is the case in the UK where there is a licence fee for TV but not for radio sets. It will help the growth of radio and TV considerably if the social welfare programmes of Akashvani and Doordarshan are paid for by the government, in the same manner as it pays for education and hospitals.

3. Two separate independent broadcasing corporations for radio and TV will broadcast/ telecast radio and TV programmes for entertainment, commerce and industry. Their income will be from commercial programmes. They will observe the code set for them for broadcasting.

Mr Sunder T. Vachani, managing director of Weston Electroniks Ltd, New Delhi is president-elect of the All India Radio & Electronics Association (AREA).

The formation of these corporations will ensure the autonomy needed by radio and TV. And the competition among Akashvani and Doordarshan and the independent broadcasting corporations will ensure better programmes to the public.

Mr H.K.L. Arora, proprietor of Television Combine, New Delhi, has been a president of the AREA

It is not realised that the slow growth of radio in India has been due to inadequate coverage, unsatisfactory programmes and the language of the broadcasts. What good is autonomy if it does not lead to an improvement in the programmes?

It has been found necessary to split Samachar into a number of agencies, why not split AIR and Doordarshan too?

Lastly, the present names of Akashvani and Doordarshan should continue. Akash Bharati is more suitable for Indian Airlines. □

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IMPORT POLICY: LITTLE LIBERALISATION FOR ELECTRONICS INDUSTRY

The import policy for the year 1978-79 released recently by the ministry of Commerce, government of India, has been hailed as a liberal one. But how liberal is it for the electronics industry?

A scrutiny of the three green books concerning the import and export policies does not inspire one who is looking for any new, far-reaching concessions for the industry. On the contrary, electronics units—especially those making components—feel disappointed that their pleas for reduction of import-duties on crucial raw materials remain unheeded.

Much has been made in the Press about the liberalisation of capital goods, imports of 14 categories of industries including the one relating to the "manufacture of the professional grade electronic components." The new policy stipulates that the applicants for machinery for this group of industries will be permitted to call global tenders. The Indian suppliers will also be allowed to compete. The final decision will be taken by a committee set up in the Department of Heavy Industry. Comparison will be made between Indian and foreign offers. If an Indian supplier is successful in winning a bid, he will be permitted to import raw materials, components etc, without any restriction from indigenous availability angle. The rate of duty on such imports would not exceed the rate of duty leviable on the concerned capital goods.

A special procedure exists under the Department of Electronics for clearance of the imports of Computer Systems with a c.i.f. value of Rs 500,000 or more. This includes the determination of the essentiality of tenders for securing bids (where import is considered necessary), evaluation of bids and the selection of the computer systems to be finally purchased. Such actual users have necessarily to apply only through the Department of Electronics (Computer Directorate), Vigyan Bhavan (Annexe), Maulana Azad Road, New Delhi. Actual users (industrial) can do so in the prescribed form and manner given in the Hand Book for Import Export Procedures, 1978 - 79. Others may apply in the format obtainable from the said directorate and submit the application accordingly.

The Computer Maintenance Corporation (CMC) will be the designated procurement agency for spares, tools and test equipment in respect of all computer systems maintained by them. They will procure spares in bulk up to a maximum value of three per cent per annum of the c.i.f. value of imported computer systems maintained under their own responsibility or in respect of similar systems maintained by users who may register themselves with CMC for procurement of spares (CMC may set up bonded warehouses on the basis of understanding with manufacturers for such systems).

All actual users other than those mentioned above may obtain spares on the basis of Open General Licence (subject to the actual user condition) up to a maximum of three per cent per annum of the c.i.f. value of the imported computer system in use by them.

In respect of all indigenously manufactured computer systems, maintained by the Computer Maintenance Corporation (CMC) or in-house by the users or by the idigenous manufacturers as a part of their services to the users, spares up to a maximum of 1/2 per cent per annum of the sale price of the computer system may be imported under Open General Licence (subject to the actual user condition).

In the case of small-scale units whose value of licences for raw materials, components and consumables for the period 1976-77 or 1977-78 is Rs 50,000 or less, automatic licences may be granted on repeat basis, without reference to past consumption, but without any additional increase of 10 per cent either. These licences will be granted for restricted items appearing in Table A. However, if such units claim automatic licences on the basis of consumption, though the value of their past licence was Rs 50,000 or less, 10 per cent increase will be allowed.

The value set out against an automatic licence can be utilised for importing any of the items listed in Table A, but such imports should not exceed 10 per cent of such value, and those of any single item should not be more than Rs 50,000. An item will count as one even if it may be used in various sizes and specifications. It is expected of actual users (industrial) that they will utilise the facilities given only to import such items as are in conformity with the respective provisions of their industrial licences or regulation certificate.

Actual users (industrial) will also be eligible to get licences calculated at 0.1 per cent of the ex-factory value of production during the last three years for the purposes of providing warranty coverage/ after sales obligations to their customers.

TABLE A

Electronic Components, Raw Materials and Some Electronic Equipments Included Under the List of Restricted Items

I. Electronic Components:

1. Antennae other than those included in the banned list.
2. Ceramic elements for pick-up cartridges.

3. Components of electronic equipments, converters, rectifiers and rectifying apparatus containing thermionic valves, transistors or similar semiconductor devices or electronic micro-circuits or capacitors other than paper capacitors.
4. Components for relays, connectors and switches.
5. Connectors other than those included in the banned list.
6. Copper Beryllium ingots, sheets, strips, rods, wires and formed products.
7. Diffused wafer/ chips for semiconductor industries including ICs.
8. Dry reed switches other than those included in the banned list.
9. EHT transformers for TV receivers above 36 cm.
10. Electrolytic capacitors up to 350 volts.
11. Etched aluminium foil.
12. Ferrites (other than hard ferrite magnets for loudspeakers and ferrite antenna rods for radio receivers).
13. Metal film resistors.
14. Microphone cartridges
15. Microwave components of all types.
16. Paper cones for loudspeakers
17. Printed circuit board.
18. Relays of all types
19. Selenium rectifiers/ plates/ stacks.
20. Switches of all types
21. Tantalum capacitors.
22. Tape deck mechanism
23. Testing and cleaning cassettes
24. Thyristors/ silicon control rectifiers (convertor grade) below 30 amps and above 150 amps up to 500 amps
25. Wirewound resistors other than those included in the banned list.
26. All other connectors, relays and discrete silicon semiconductor devices including silicon power semiconductor devices, not appearing in the banned list.

II. Raw materials, components and consumables, if ***(a) of a grade specially*** *made for electronics industry application, (b) marketed as such, and (c) required by an actual user (industrial) for his manufacturing process:*

1. Acetic acid
2. Acetor co-polymer
3. Acrylic resin based marking paints
4. Aluminium foil/strips below 1 mm thick, close tolerance, 99.0% and above purity.
5. Aluminium wire 99.9% and above purity.
6. Ammonia
7. Ammonium alginate
8. Ammonium chloride
9. Ammonium pentaborate
10. Basic bismuth carbonate oxide nitrate.
11. Basoplast
12. Berylium copper/brass stips, bronze (alloy of brass and tin) wire, silver plated
13. Bentonite
14. Benzilidine acetone.
15. Benzotriozol
16. Boric acid, high purity.
17. Brass rods up to 8 mm diameter, dent free, free cutting quality in close tolerance.
18. Brass tubes thinner than 32 SWG diameter ranging from 2 mm to 13 mm (For car radio aerials, brass tubes of up to 0.8 mm wall thickness (21 SWG) with diameter ranging from 2 mm to 16 mm will be permitted).
19. Cadmium nitrate
20. Calcium chloride.
21. Calcium phosphate (dibasic).
22. Calcium phosphate (tribasic)
23. Carbon black.
24. Carbon suspension/inclusive of carbon and graphite conductor pow-
25. Carbon tetrachloride.
26. Castrolese.
27. Cerium oxide.
28. Chlorazol black.
29. Copper foil of high purity (99.9%) and close tolerance (thickness 0.05 mm and 0.008 mm, tolerances 0.005 and 0.008 mm).
30. Copper sulphate.
31. Dimethyl alkyd benzyl ammonium bichromate.
32. Di-methyl/formaldehyde.
33. Diphenyl propane resin.
34. Electrolube.
35. Epoxy resin, their hardners and solvents.
36. Ethylene glycol.
37. Gold chloride.
38. Hydrochloric acid anhydrous.
39. Kilopise.
40. Litz wire rayon covered copper wire.
41. Manganese nickel strips gold plated.
42. Melamin resin.
43. Metalised or plain film polyester/ polycarbonate/ polypropylene/ teflon/ polyethylene.
44. Meta oidaolic acid.
45. Methyl hydroxy ethyl cellulose.
46. Mowilith.
47. Nickel carbonate.
48. Nickel chrome wire thinner than 32 SWG.
49. Nitric acid.
50. Nylon cloth 355 mesh.
51. Nylon cord (1.5 to 4 mm in dia).
52. Opanol (Isobutylene polymers).
53. Palladium chloride.
54. Pedacryl resins.
55. Phenolic resin/ epoxy resin/ polyester resin/ epok coumarons resin, their hardners and solvents.
56. Phosphoric acid.
57. Phosphor-bronze strips (sheets up to 0.3 mm thickness), electrically good conductors and having good springly quality.
58. Phosphorous pentaoxide.
59. Plastic glue, phenolic resin, rubber glue Mobilicar 'M'.
60. Polycarbonate phenolic resin/ethyl alcohol 99%/dimethyl alcohol 99%
61. Polymeth acrylic resin.
62. Polymethyl-methacrylate glue.
63. Polyvinyl acetate.
64. Polyvinyl butyral resin
65. Potassium stannate.
66. Prevental.
67. Pulp for manufacture of loudspeakers cones.
68. Resin solution, ethyoxyline resins.
69. Resistance tapes, all types.
70. Resistance wires (all types) other than nickel chrome type
71. Salicylic acid..

III. Measuring instruments like Ammeters, Voltmeters, Wattmeters, Meggers, Frequency meters, etc.

IV. Radio and TV coils.

V. Ultrasonic devices including ultrasonic flaw detectors.

VI. Components of X-Ray and Electro-medical equipments.

VII. All components, consumables, sub-assemblies or modules howsoever described not appearing individually in this list or the banned list, required by an actual user (industrial) for the manufacture of any of the goods specified below:

1. Industrial process control instruments.
2. All types of calculating machines/ cash registers/ invoicing machines.
3. Telecommunication equipment.
4. Radar and wireless equipment.
5. Electronic instruments.

6. Tape recorders
7. Microprocessors.
8. Computers/ peripherals.
9. High frequency induction/ dielectric heating equipment.
10. Telemetry/data logging/data acquisition systems.
11. Convertors/invertors including thyristor control drives.
12. Rectifier equipment including static excitation systems.
13. Electronic weighing equipment.
14. Semiconductors including power diodes/thyristors.
15. Switches/ relays/ connectors.
16. Electrolytic capacitors.
17. All types of magnetic tapes.

TABLE B

Electronic and Telecommunication Equipment Covered by the Import Policy for Registered Exporters

Export Products	*Import replenishment percentage*	*Materials permitted for import*	*Remarks*
Telecommunication Equipment including Telephones, Exchange Equipment and Teleprinters:			
1. Electro-mechanical telephone exchange equipment	15%	(a) Capacitors (b) Connectors (c) Resistors	(in the banned list)
2. Electronic telephone switching equipment	15%	(a) Transistors (b) Diodes (c) Connectors (d) Resistors (e) Reed switches (f) Integrated circuits	(in the banned list)
3. Telecommunication equipment, other than switching equipment, transmitters and radars	15%	(a) Transistors (b) Diodes (c) Connectors (d) Resistors (e) Capacitors (f) Reed switches (g) Magnetrons (h) Integrated circuits (i) Silicon power diodes/ thyristors	(in the banned list)
Electronic Equipment and Appliances:			
1. Pre-recorded cassettes	30%	Audio magnetic tape	
2. Tape recorders	10%	Cassettes	
3. Loudspeakers	10%	Hard ferrite magnets for loudspeakers.	
4. TV sets	20%	(a) TV deflection coils for TV picture tube of size above 36 cm. (b) TV tuners (c) TV tubes	
5. Record players and record changers	10%	Cartridges & Stylus	

Replenished licences issued to a registered exporter on his own exports will be valid within the value of the licence for the import of samples up to Rs 10,000, provided the import of each type of sample is not more than two in number. This facility will not be available for the import of the following items:

1. TV set
2. Air conditioner
3. Refrigerator
4. Cooking range
5. Washing machine
6. Motor cycle, scooter and moped
7. Radiogram
8 Tape recorder
9. Amplifier
10. Camera/Movie camera
11. Movie projector
12. Gold set
13. Watch
14. Electric shaver
15. Hair dryer
16. Flash gun and
17. Exposure meter

But this restriction will not apply to the import of TV set, Radiogram, Tape recorder, Amplifier and Flash gun by a manufacturer - exporter who is an actual user (industrial) himself manufacturing such item(s).

Among the public sector agencies through which the import of items is canalised, Electronics Trade and Technology Development Corporation (ETTDC) is the only one dealing with the electronics industry. The total number of canalised items for all the public sector agencies has been reduced to 67, and only two of them—calculator chips and TV picture tubes—belong to the electronics industry. Thus, the ETTDC continues to enjoy the monoply to import TV picture tubes and calculator chips.

The list of electronic items whose import is banned is long; it has been set out in Table C.

TABLE C

Electronic Items and Professional Grade Electronic Components whose Import is Banned

1. Audio magnetic tape in reel, cassette, jumbo rolls, cartridges and pancakes.
2. Blank cassette (0-0)
3. Loudspeakers (cone type) below 30.5 cm/unit thorns
4. Hard ferrite magnets for loudspeakers
5. Ferrites
   (a) Antenna rods for radio receiver
   (b) Pot cores of sizes 18 x 11 mm & 26 x 16 mm
   (c) Toroidal cores of type T-10, T-27, T-30 and T-45
6. TV deflection coils for TV picture tubes above 36 cm size
7. Telescopic antenna for radio and TV
8 TV tuners
9. Cartridges and stylii for record players/ changers
10. Linear integrated circuits types CA3085, CA3085A, CA3028A. CA3020, CA3020A and CA3021
11. Testing and cleaning cassettes
12. Metallised ceramic rods for metal film resistors
13. Carbonised rods for carbon resistors
14. Silver coated ceramic discs
15. Sub-assemblies, modules or 'room temperature vulcanised' sandwiches made of on diffused semiconductor chips.

16. Silicon power diodes (except schottky diodes)/ bridges/ stacks above 1 amp and up to 500 amp
17. Thyristor/silicon control rectifiers (convertor grade) above 30 amp and up to 150 amp
18. Microphones for public address system
19. Professional grade electronic components:

(i) Diodes

CA44/1N914/1N4148
CA52/1N903
CA57/1N903A/1N4152
CA59/1N916A
CA72/1N4089
CA74/1N3654/1N4151
CA77/1N3606/1N4152
CA79/1N3731/1N449
CAZ5. 1A/1N3511/1N5231B/1N751A
CAZ30.OA/1N3529/1N5256B/1N972
CAZ5.6A/1N3509/1N5229/1N749/1N749A
CA25.6A/1N3512/1N5232B/1N752A
CAZ4.7A/1N3510/1N5230B/1N750A
CAz7.5A/1N3515/1N5236B/1N755A
CAz8.2A/1N3516/1N5237B/1N756A
CAZ16A/1N966/1N5536/1N4110/1N5221/BZX83C16/ BZX97C16
GO-3
EC406/Silicon rectifier device of 6 amp rating in DO-4 package
EC412/silicon rectifier device of 12 amp rating in DO-4 package

(ii) Transistors:

2N706, 2N718A, 2N720A, 2N869, 2N911, 2N918, 2N930, 2N1482, 2N1613, 2N1711, 2N1890, 2N2102, 2N2218, 2N2218A, 2N2219, 2N2219A, 2N2221, 2N2221A, 2N2222, 2N2222A, 2N2369A, 2N2904, 2N2904A, 2N2905, 2N2905A, 2N2906, 2N2906A, 2N2907, 2N2907A, 2N3019, 2N3054, 2N3055/ MJ2801/ KSD3055, 2N3251A, 2N3866, 2N4033, 2N5071, 2N6371, BD115, ECPO55/ECNO55, BFW10, BFW11, BFW61

(iii) Thyristors (SCRs):

26TB4, 26TB8, 26TB10, SS685, SS688, SS690, SS692, SS694

(iv) Connectors:

(a) *Printed circuit board connectors:*
1. Tuning fork type in 10, 12, 16 & 22 contacts.
2. Plug/receptacles harp type in 11, 25 & 33 contacts.
3. Pin and socket type in 13 & 31 contacts.

(b) Rack and panel connectors:
1. Blue ribbon type in 8, 24 & 32 contacts.
2. Subminiature mini rack type in 9, 15, 25 & 50 contacts.

(c) *Radio frequency (RF) coaxial connectors:*
1. 83-1SP/PL-259/83-822
2. 83-1SPN/PL-259A/83-756
3. 83-IR/SO-239/83-798
4. UG88G/u
5. UG2908/u

(d) Audio multipin connector of 5 contacts pins.

(e) *Multipin circular industrial and military connectors:*
1. Threaded coupling type:
   MS3102 R in 10SL, 14S, 16S, 18 & 22 shell sizes.
   MS3106 R in 14S, 16S, 18 & 22 shell sizes
   MS3100E in 14S shell size
   MS3101E in 14S shell size
   MS3102E in 14S shell size
   MS3106E in 14S shell size
2. Bayonet coupling type:
   62 GB-14E-12-3P and 62 GB-16F-12-3S

(v) Resistors

(a) Insulated carbon film resistors of ½ watt power-rating in values 10 ohm to 1 megohm.
(b) Insulated metal oxide resistor of 0.5 watt power rating in values 10 ohm to 1 megaohm
(c) Non-insulated wirewound resistors of following types:
2.5 watt power rating of values 10 ohm to 10 kilohm.
6 watt power rating of values 1 ohm to 20 kilohm.
9 watt power rating of values 1 ohm to 60 kilohm.
10 watt power rating of values 10 ohm to 24 kilohm.
12 watt power rating of values 1 ohm to 100 kilohm.
15 watt power rating of values 10 ohm to 6.9 kilohm.
25 watt power rating of values 10 ohm to 18 kilohm.
50 watt power rating of values 10 ohm to 35 kilohm.
100 watt power rating of values 10 ohm to 91 kilohm.

(vi) Capacitors

(a) Non-hermetically sealed fixed polystyrene capacitors	— 63 volt rating in values from 100 pico farad to 1800 pico farad. — 250 volt rating in values from 100 pico farad to 24900 pico farad.
(b) Non-hermetically sealed metallised polyester fixed capacitors flat and oval type, wrap and fill construction	— Up to 630 volt DC rating in capacitance range 0.01 to 1 micro farad.
(c) Non-hermetically sealed metallised polycarbonate capacitors, flat and oval type, wrap and fill construction	— 63 volt rating in values from 0.1 to 10 micro farad.

(vii) Dry Reed Switches

(a) DRR-1/MR-906/MR-908/MR-956/ MR-958/ DR-113/ DR-114/ 63-4321-1/ MRA-203/ DRA-200.
(b) MTRR-2/ MR-458/ 2026/ DR-300/ MMR-090/ 560-2/ TRA-291/ DRD/ 221/FOR-7.
(c) DGA-124/N/DGD-090/ DGD-106/ DGD-135/ ORD-100 OK

(viii) Magnetrons

BEL-7008/YJ1010

(iix) Cathode Ray Tubes

(a) BEL 130C1p1/5ABP1/DG13-34/DB13-134
(b) BEL 180C1P7/7MP7
(c) BEL 260C1P7/10WP7/10M166P7
(d) BEL 180C2P7/7ABP7

20. Battery eliminators
21. Dry cell batteries
22. Electronic flash guns
23. Electronic (solidstate) fan regulators
Fish finders
25. Germanium transistors
26. Hearing aid batteries, types UM-3 and IR-6
27. LT/HRC fuses except suitable for diodes and thyristors
28. Telephone cables
29. Telephone switchboard cables and cordages
30. Transistor headers
31. TV pattern generators
32. Voltage regulators and stabilisers
33. Wheatstone bridge, kelvin bridge, capacitance bridge, RLC bridge
34. Wirewound potentiometers and rheostats
35. X-ray tubes of rating from 30MA to 500MA.
36. 'All consumer electronic items, howsoever described, including radio receivers, transistor radio receivers, TV games, electronic watches, AM/FM radio receivers, amplifiers, car radios, tape recorders, car cassette players, TV receivers, record players and record changers, intercom equipment, calculators, as well as kits/ready to assemble sets thereof.
37. All professional electronic systems, equipment, howsoever described, as well as kits/ready to assemble sets thereof. □

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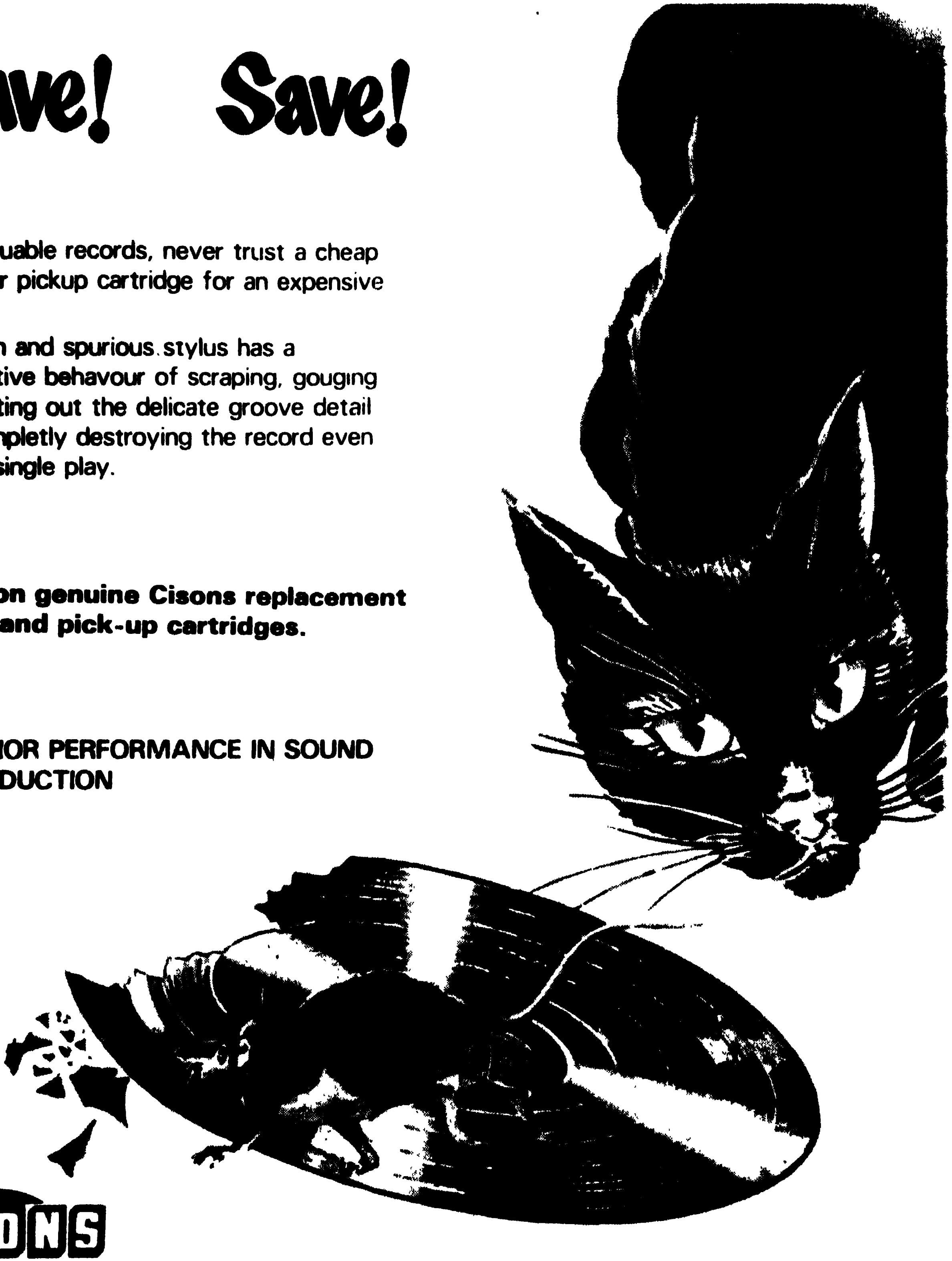

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Tape Recorder Industry in India

If you happen to possess an Indian tape recorder made more than five years ago, place it near a stereo cassette tape recorder produced recently by an Indian company, and compare the two of them. You will discern immediately how much progress the Indian tape recorder industry has made in the last few years.

The progress is by no means superficial. The indigenous production of several critical components such as tape deck mechanism, micro motors, and now attempts to make electret microphones and record/play heads, have given new confidence to the assembly units. Last year (in 1977) they produced 111,789 tape recorders (including radio tape recorder combination sets). During the previous year (1976) only 68,718 sets were produced, and the year before just over 50,000 sets were made.

The growth rate registered by the small-scale sector for tape recorders was about 90 per cent during 1977 as against 50 per cent registered by the large-scale sector. One of the reasons for this was the 15 per cent excise duty concession granted to small-scale units as compared to large-scale units.

The production of radio - cum - tape recorder units, which had just started in 1976, was taken up quite seriously by a number of units during the year 1977. The total production of such combination sets in 1977, in the small - scale as well as large - scale sectors, was around 30,000 pieces.

There is now a very diverse variety of tape recorders available in the market. You can get hand - held cassette tape recorders, desk type cassette recorders, reel type mono as well as stereo tape recorders, stereo cassette tape recorders, stereo cassette players for cars, and radio/tape recorder combinations for the home and radio/tape recorder combinations for cars. The video tape recorder is perhaps the only black sheep missing in India.

Year	*Production*
1977	111,789 sets
1976	68,718
1975	50,300
1973-74	50,000 approx
1972-73	36,000 approx

As is evident from the above table, the production of tape recorders was stagnant till 1975. The industry really began to grow in 1977 only when commercial production of tape deck mechanism was taken up seriously by 2-3 units. Before that virtually everything, except the electronic amplifier section, was being imported.

It is now expected that the production of tape recorders during 1978 would nearly double itself to meet the 300,000-sets demand forecast for 1978 - 79 by the Electronics Commission. The commission had also forecast the demand at about 600,000 tape recorders by 1983-84 in its perspective report on electronics in India published nearly three years ago.

The industry can thus look forward to an expanding market in this country, provided the manufacturers take care to steadily improve the quality of their products along with reducing prices as a result of economies of scale.

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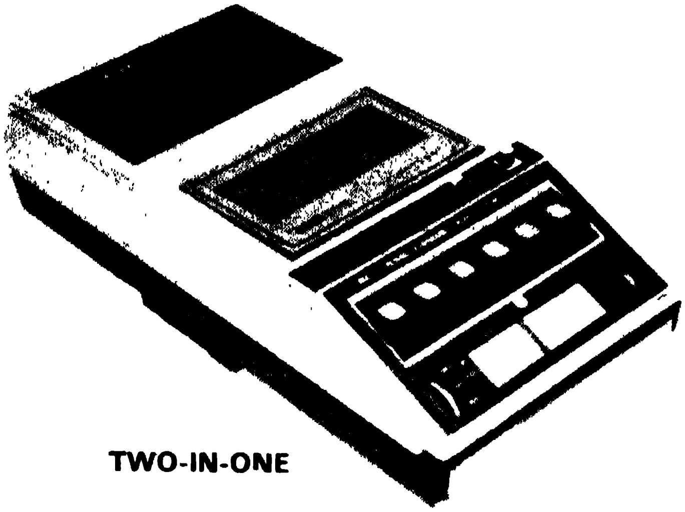

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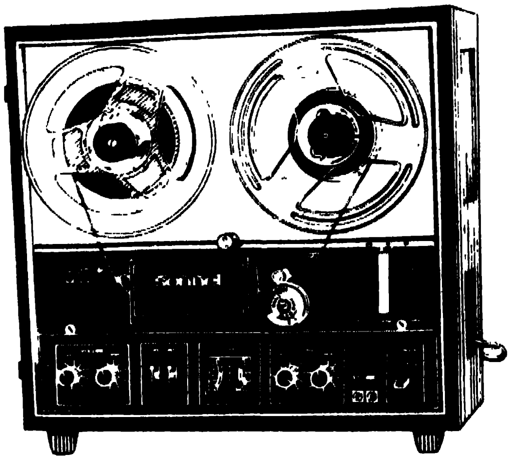

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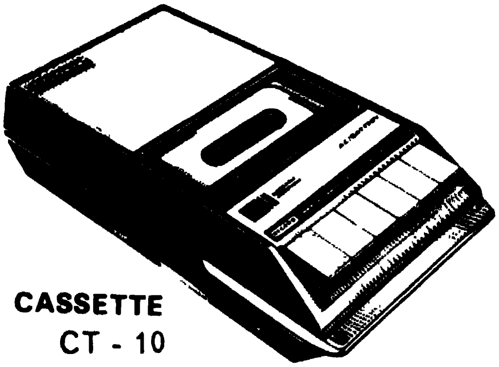
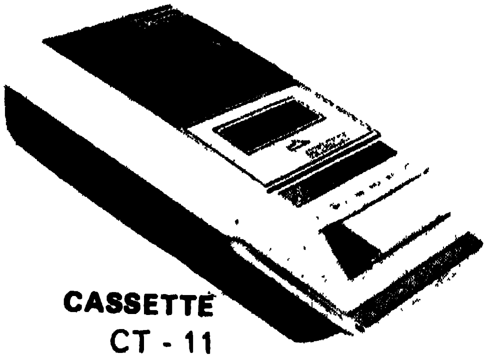


CASSETTE
CT - 10



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Tape Deck Mechanism Industry in India

M.L. Sethia

Tape deck mechanism is a vital component for the cassette tape recorders. The quality of a tape recorder very much depends on the quality of tape deck mechanism being used in it. The assembly of tape recorders in India was started by using imported tape deck mechanism, mostly from Japan. It is only since 1973 that some indigenous industries manufacturing tape deck mechanisms have come up with their products.

Tape deck mechanism is a very precision electromechanical component. In India, to manufacture it all facilities are required in-house to make a quality product. But in countries like Japan, Taiwan and Korea, where this industry is booming, and who meet about 95 per cent demand of the world, it looks like an assembly industry, because the tape deck mechanism manufacturers get their sub-assemblies and components from the specialised manufacturers of press components, moulded components, motors, magnetic heads, rubber components, turned and other components, who not only manufacture the aforesaid components for tape deck mechanism industry but for other industries as well.

In India, a manufacturer of tape deck mechanism has to arrange everything on his own He has to make drawings, press tools, moulds, jigs, fixtures and also has to instal facilities of plating, sub-assemblies, final assemblies etc, because it is difficult to get reliable raw materials/ components as per one's requirement. As the tape deck mechanism is an assembly of various components, unless all components as per standard drawings are obtained, it is difficult to manufacture this assembly. Thus a good toolroom facility having sophisticated machines like jig boring, optical grinder, milling, surface grinder etc, equipped with various types of testing and quality control machines, is essential for this industry, particularly in India. About four manufacturing units having full facilities have already been set up in our country to manufacture tape deck mechanism and they have already commenced commercial production.

This industry is labour intensive. It gives opportunity of employment to senior engineers, diploma holders, managers, highly skilled, skilled as well as unskilled persons.

Tape deck mechanism is an import substitute item, but is still being allowed for import. Our country needs fast growth of this industry, not only to meet the indigenous demand of tape recorder industry but also to exploit the great potential it has for exports because of cheap availability of labour in India. But, unfortunately, the industry, although considered as a select industry, is facing the following problems:

1. The custom duties on imported raw materials/ components are very high. The duty on micro motors, a vital component of tape deck mechanism, is 164 per cent whereas the duty on the complete tape deck mechanism being allowed for import is 120 per cent. Moreover, on certain moulding raw materials, the duty is as high as 208 per cent. Thus, it becomes difficult for the indigenous industry to compete with the imported tape deck mechanism.
2. The tape deck mechanism has been brought under Central Excise Traiff Item 37AA, although it is still allowed for import. The excise duty applicable is 10 per cent up to the sale of Rs 2.5 million; for sale above this limit the excise duty payable becomes 25 per cent. It is really surprising that on one hand the tape deck mechanism is allowed for import and on the other hand excise has been levied so that the industry cannot compete with the foreign goods. Moreover, excise slab is increased with the increase of the production. Thus it becomes disadvantageous for a unit to increase production.
3. This industry requires raw materials of specific standards. These raw materials are not available in the country. Although, the import licences are granted, but because of small requirements it becomes difficult to actually import. To small-scale industries the raw materials required as per their specifications should be available through some proper government agencies. This will greatly help the growth of the industry.
4. There is a good scope of export for this item, provided the government gives due encouragement. The developed countries like Japan, Taiwan and Korea are producing in very large quantities and hence their product becomes very economical. But since we have cheap labour available, if the government gives proper incentive by way of cash assistance and REP entitlement this industry can also export. The cash assistance and REP entitlement should be at least 25 per cent and 30 per cent respectively to subsidise this industry.

In the recent import policy it is really surprising to note that the electronic components have not been

---

Mr M.L. Sethia is managing partner of Electronic Industries of India, one of a few tape deck mechanism manufacturers in India.

included in appendix 17, and hence no REP entitlements would be allowed. Thus it seems that the government does not want to encourage export of electronic components which can offer lots of employment, although it seems contrary to their announcement that they want to encourage the export of non-traditional items. The government should give a second thought and must include electronic components in the export list so that REP entitlement is allowed to the industry.

Since end use of the tape deck mechanism is in an equipment like tape recorders, which not only record and reproduce music, but are required in this modern age in every walk of life, there is a great potential for this industry to grow. Not only would the indigenous demand by the end of 1980 become approximately 0.5 million pieces, but it may be exported in good numbers if due importance is given to this industry by the government.

In view of the good employment opportunity offered by this industry, and as the item is still allowed for import, we hope government will come forward to encourage this industry. □

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How to use a Cassette Recorder in the Car

Deepak N. Nair

This simple and cheap unit will enable the in-car operation of cassette tape recorders, record players, electronic calculators and transistor radios, without worrying about the drain on the equipment's internal batteries. The idea behind this unit is to drop the 12V DC available from the car battery to 6V DC required for the equipment, without facing the difficulties encountered in tapping off 6V from the main battery, or in fixing big and power-consuming dropper resistors.

The circuit is as shown in Fig. 1, and is designed for cars with a negative ground. Modifications for use with positive ground vehicles are given later in the article. The zener diode Z determines the reference voltage and thereby controls the output voltage. T1 is a power transistor which takes a small base current from the zener diode Z, and amplifies it, feeding the resulting amplified current to the load (in this case, the electronic equipment), through resistor R2. In no load conditions (i.e. with the output circuit open), transistor T1 remains off. But as soon as a load is applied, the current through T1 increases until the voltage at the output is a little less than that of the zener diode Z. If for any reason, the output voltage increases, the voltage across T1's base-emitter decreases, causing the collector current to drop. On the other hand, if the output voltage decreases, the base-emitter voltage will increase, raising the collector current. Both these conditions will result in the output voltage remaining constant in spite of the varying load currents.

Resistor R2 and transistor T2 form the short-circuit protection circuit. When the applied load draws a current of less than 280 mA, the voltage drop across resistor R2, as given by Ohm's Law, will be less than

$$E = i R$$
$$= 0.28 \times 1.8$$
$$= 0.504 \text{ V}$$

Thus, $E = 504$ mV

As this voltage is applied between the base and emitter of transistor T2, it will be insufficient to drive the transistor. If, however, the current drawn by the load were to exceed 280 mA, the voltage drop across R2 would be sufficient to start T2 conducting, which in the process will draw current from the zener diode Z. At current drains of slightly more than 280 mA, this will not have much effect, but if the voltage drop across R2 increases further, T2 will draw more and more current from the zener diode until the latter stops conducting, thus causing the output voltage to fall to a level such that no more than 330 mA flows. As this is well within the capability of T1, there is no danger of its destruction even when the output leads are accidentally shorted.

Construction

The entire unit can be built into a small metallic box. The power transistor can be bolted to the box such that its body (collector) makes proper contact with the metal box. The remaining components can be soldered onto a small tag strip or a piece of bakelite fitted with eyelets. Parts placement and layout is not at all critical.

Conversion to positive ground

The above circuit can be safely used in positive ground vehicles, simply by interchanging the input connections, i.e. the collector of T1 should be connected to the negative supply terminal (battery), and the cathode end of the zener diode may be connected to the car's body (ground). But in this case, an insulating mica washer must be put between the power transistor and the metal case, and care must be taken to ensure that T1's body does not touch any part of the car's body.

A safer method to overcome this problem would be to replace transistor T1 (PT6) by an npn device such as the PT4, and T2 (BC 177) by a BC107. The zener diode Z will also have to be reversed as shown in the complete diagram

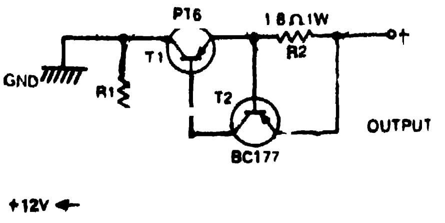

Fig. 1: Circuit for use with Negative Ground vehicles.

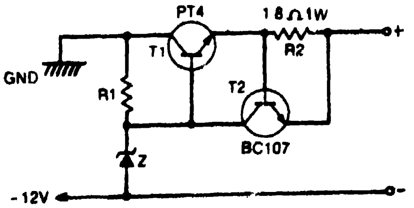

Fig. 2: Circuit for use with Positive Ground Vehicles.

COMPONENTS LIST (For 6V output)

		Negative Ground	*Positive Ground*
R1	Resistor	680 ohms, ¼W	680 ohms, ¼W
R2	Resistor	1.8 ohms, 1W	1.8 ohms, 1W
Z,	Zener Diode	6.2V, 400mW	6.2V, 400mW
T1	Transistor	PT6	PT4
T2	Transistor	BC177	BC107

Misc.: Tag strip, Metallic box, nuts & bolts, hookup wire etc.

in Fig. 2.

Further modifications

. If an output of 7.5V or 9V is required, as is the case with certain imported tape recorders, the same may be obtained by changing the zener diode Z and the resistor R1, as shown in the table below.

Required Output Voltage	Zener Diode	Resistor R1
6V	6.2V	680 ohms, ¼W
7.5V	7.7V	390 ohms, ¼W
9V	9.1V	220 ohms, ¼W

On the other hand, if the equipment to be used draws a normal current of more than 280 mA, the resistor R2 may be reduced to 1.5 ohms or 1.2 ohms. In the latter case, the maximum current output would be about 400 mA. In no case must resistor R2 be made less than 1 ohm, for by doing so, the protection circuit will begin operating at a load current which will be high enough to destroy transistor T1. Thus the very purpose of the short circuit protection components will be defeated. ☐

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Make Yourself This Level Indicator For a Tape Recorder

Nitin Mehrotra

Most tape recorders and a few cassette decks do have built-in sound level indicators. But what do you do when your machine does not have one! Live with overmodulated and distorted recording due to the recording level being set too high or with hardly audible sound since you were overcautious during recording, I suppose. So did I until one day in anger and frustation I sat down and built myself this rugged and extremely versatile level indicator.

Fig. 1 shows the circuit diagram of an indicator comprising transistors and an incandescent lamp. The lamp glows as long as the sound level does not exceed a certain value which can be adjusted. If the voltage exceeds this value ($>$250mV), even if only for a brief moment, the monostable multivibrator is triggered and the lamp is extinguished for a short time. It remains dark until the multivibrator returns to its original position after the delay period (of approximately 0.3 sec.) has elapsed. This lengthening of the pulse is necessary to indicate also brief excess level peaks.

Fig. 2 gives another version of the indicator's circuit. The lamp here stays off as long as the signal level does not exceed the critical value. When the input exceeds the critical level the lamp comes on.

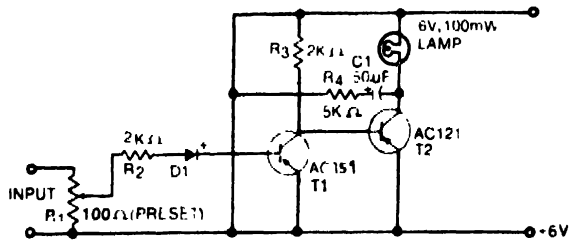
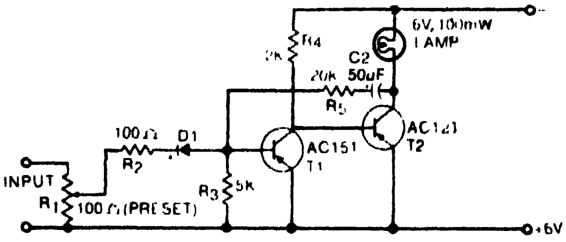


Fig. 1



Here R2 is optional

Fig. 2

The potentiometer R 1 has to be adjusted only once, and that is after installation. R 1 is provided to help the cassette owner adjust the indicator for his personal machine. In most machines the head saturates at a level around 250mV to 300 mV so that R 1 should be slightly less than max. However, if you have a head which needs a higher level and saturates at a higher voltage, then decrease R 1 so that the indicator shows over-driving at a higher level.

As can be seen in both the cases, only intermediate values are indicated.

To use the indicator, connect if after the recording amplifier. In most of the cassette recorders the head is connected to the amplifier via a low-value capacitor. Connect the live input of the indicator *before* the capacitor.

Put the recorder in the record mode and when the source signal starts do the following procedure: If you are using circuit shown in Fig. 1, adjust the level control on your recorder so that the light stays on nearly all the time. But make sure that the level set is not verry low and that increasing it causes the lamp to go out fequently. If you are using the circuit shown in Fig. 2, adjust the level control so that the lamp is off, but increasing the level at once causes it to come on frequently.

The whole unit can be made very compact. Built on a 3.8 cm X 2.5 cm perforated board; mine packs into the cassette recorder itself. The lamp is mounted on the front plate through a hole. A standard lamp mounting can be used. The power can be derived from the cassette recorder's power supply itself.

The diode D 1 can be any small-signal diode, as used in crystal detector sets etc. ☐

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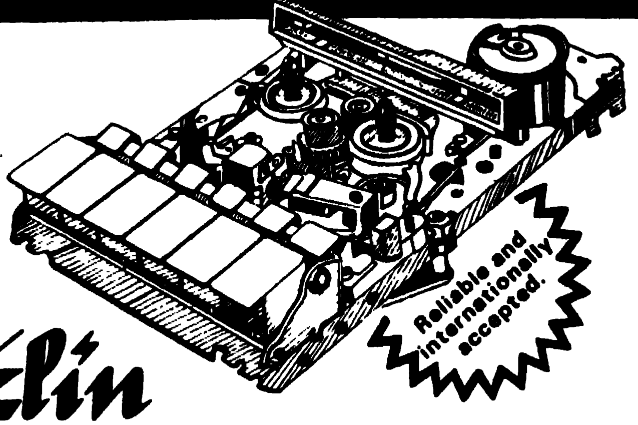
BUT WE'RE THERE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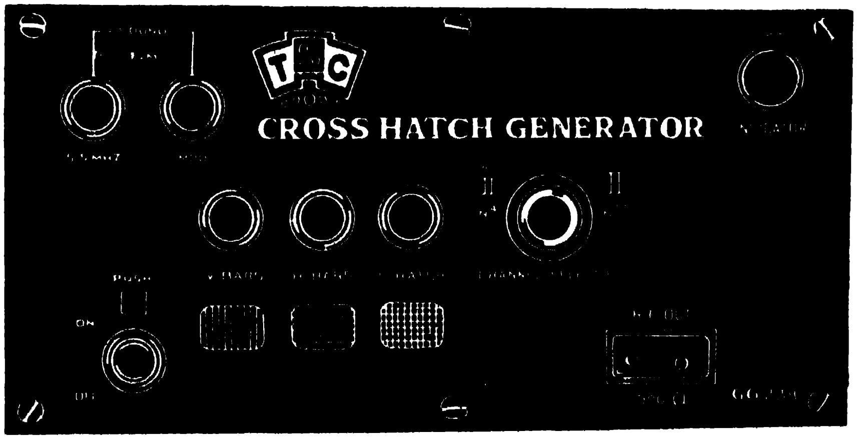

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3.	Radio & Communication Traders III-H/10 Lajpat Nagar, New Delhi	5,000	
4.	Miniature Electronics 151, Okhla Industrial Estate, New Delhi	10,000	
5.	Eskay Electronics (India) Pvt. Ltd. C-223 Rewari Line, Industrial Area, Phase-II, New Delhi	12,000	
6.	Televista Electronics (P) Ltd 239 Okhla Industrial Estate, New Delhi	20,000	
7.	Jain Radio Works Bharat Ram Road, 24 Darya Ganj, Delhi	20,000	
8.	Calcutta Gramophone Agency Panna Bhavan, 2, Ansari Road, Darya Ganj, New Delhi	20,000	
9.	Eta Radio Industries Eta Sadan, Patnamal Street (Opp. Dhariwal Shop), Pahari Dhiraj, Sadar Bazar, Delhi	5,000	
10.	Priti Electronics (P) Ltd XI/3833, Pataudi House Road Darya Ganj Corner, New Delhi	(i) 5,000 (ii) 5,000 (iii) 5,000	Tape recorders Car Stereos (40% export) Car stereos with radio (75% export)
11.	Asian Electronics 7/33 Ansari Road, Darya Ganj, New Delhi	5,000	
12.	Electroplastics D-68 Lajpat Nagar, New Delhi	5,000	
13.	General Radio Corporation 2/2 Jhandewalan Industrial Estate, New Delhi	5,000	
14.	Dipsons 175 N.D. Storey, Lajpat Nagar, New Delhi	5,000	
15	Weston Electroniks Ltd 244 Okhla Industrial Area, New Delhi	10,000	
16.	Ferry Radio Corporation 362 Nirankari Colony, Delhi	4,000	Cassette Stereo, Car players (75% export)
17.	Singh Radio Company (India) Pvt. Ltd, 21 Darya Ganj, Ansari Road, Delhi.	6,000	
18.	M/s D. Pal Singh Kohli & H.K. Dass F-14/38 Model Town, Delhi	36,000	(100% export)
19.	Spaceonix, A-80 Naraina Vihar, New Delhi	10,000	
20.	Paros Electronics (P) Ltd, 5 Community Centre, Naraina Industrial Estate, New Delhi.	20,000	(80% export)
21.	Pioneer Electronics Corporation,Delhi Gate, Agra.	20,000	
22.	Mohindra Radio & TV Corporation, 89/3 Thapar Nagar, Meerut.	5,000	
23.	General Electronics of Haryana Pvt. Ltd, 17/6 Mile Stone, Main Mathura Road, Faridabad	6,000	
24.	Mr. Vijay Kumar Gupta Vishranti 17/4 Mathura Road, Faridabad.	10,000	
25.	Radio Corder Industries, 0-13 Industrial Area, Sonepat.	10,000	
26.	Sharma Engg. Corporation (P) Ltd, 174 Industrial Area, Chandigarh.	5,000	

(1)	(2)	(3)	
27.	Electronic Industrial Organisation, 4 Industrial Estate, Solan (H P.).	5,000	
28.	Electronics Industries, P.O. Thanedhar, Dist. Simla	5,000	Car radios/ car cassette tape recorders
29.	Vijay Electronics, Baroti Dist., Solan	5,000	Car cassette, tape recorders
30.	Grewal Radio Company (P) Ltd, C-39 Focal Point, Dhandari Kalan, Ludhiana	6,000	
31	Electronics & Electricals 13/210 Old Station Road, Alwar.	5,000	
32	Atlas Radio & Electronics Industry (P) Ltd, 57 GIDC Industrial Township, Naroda, Ahmedabad	5,000	
33	Parushi Electronics, Gandhi Road, Opp Mahavir Jain Temple, Ahmedabad	5,000	
34.	Parkash B. Shah 11 Shantiniketan Society, Navrangpura, Ahmedabad.	3,000	Stereo Cassette player radio (40% export)
35	Mac Electronics (India), 18 Steel Mould Industrial Estate, Sukhram Nagar, Rakhal, Ahmedabad.	5,000	
36	James Electronics, C-23 GIDC Industrial Township, Naroda, Ahmedabad.	5,000	
37	Perry Industries Opp. Jain Temple, Gandhi Road, Ahmedabad.	5,000	
38	Bhatty Electronics Corporation, 98 C & D Govt. Industrial Estate, Kandivli (W), Bombay	12,000	
39	Echjay Electronics (P) Ltd. Kanjur Village Road, Kanjur Marg, Bomaay	2,000	
40	Movac Electronics (P) Ltd, 307 Ashish Industrial Estate, Gokhle Road, (South) Dadar, Bombay.	5,000	Language tape recorders
41.	Raja Radio Company, 12 Evergreen Industrial Estate, Off. Haines Road, Bombay.	10,000	
42.	Cosmic Radios, 9-B Mahal Industrial Estate, Mahakali Caves Road, Andheri (E), Bombay.	5,000	Stereo cassette tape recorders
43.	Kartari Electronics, Road No. 28, Wagle Industrial Area, Thana.	5,000	
44.	Ajco Electronics, 47/21 Yerandawana, Pune.	2,000	
45.	Orien Electronics (P) Ltd, 30/A Usha Sadan, Colaba, Bombay.	4,000	portable car cassette tape recorders
46.	M.K Electronics & Electricals, 56 Tukoganj Path, Dewas.	3,000	
47.	Kumar Radio & Electrical Industries, Indore (MHOW)	3,000	
48	Lall Radios, 12, Jail Road, Indore	3,000	
49	National Electric, Ratnadeep Bldg , Opp. Railway Ware House, P.B. No. 94, Margao, Goa	1,800	
50.	Eskay Industries, 10 Lal Bahadur Stadium, Hyderabad.	5,000	
51.	Radio Instruments Associates Pvt Ltd, 1.10.84 Begumpet, Hyderabad	4,800	
52.	Chandrika Electronics Ltd, Shankar Bhawan, Ground Floor, B-1-174 Fateh Maidan Road, P.B. No. 13 Hyderabad. (APSSIDC joint venture)	10,000	
53.	Priyadhwani Magnetics, 57 Isaq Colony, Wellingdon Road, Secunderabad	5000	Cassette tape recorders, radio cassettes, car stereos.
54.	Priya Products, Ambalathara, Kallathamukka, Trivandrum	2,400	
55.	Universal Radio Manufacturing Company, Singur Bazar, P.O., Singur, Dist. Hoogly.	840	Radio-cum-tape recorders/tape recorders
56	Conjap Electronics Industries, 64 Dr. Algappa Chettiar Road, Vepery, Madras.	25,000	

(1)	(2)	(3)	
57.	Hi-Beam (P) Ltd, 61/3, 4th Main Road, Gandhi Nagar, Adyar, Madras.	20,000	
58.	Resa Company, B-8, 9 & 10 Industrial Estate, Guindy, Madras.	5,000	
59.	U.M.S. Radio Factory (P) Ltd, P.B. No. 3771, Avanashi Road, Coimbatore, Tamil Nadu.	10,000	
60.	Electro Mechanical Components Company, C-12 Industrial Estate, Ambattur, Madras.	10,000	
61.	KEN Electronics, Vishnu Enterprises Bldg., Algapuram Road, Salem (Tamil Nadu).	4,000	Car stereo players
62.	Electronic Agencies, 2/7 Waller's Road, Mount Road, Madras.	4,000	Cassette stereo players for automobiles
63.	Singh Trading Company Manufacturing Division, 1-9 V.S. Instronic Estate, Adyar, Madras.	5,000	Car stereo players (50% export)
64.	Mecotronics Pvt, Ltd Meco House, 11A/1 Mount Road, Madras.	(i) 10,000	Car cassette players/ cassette tape recorders
		(ii) 10,000	Car cassette-cum-radio combinations (80% export)
65.	Zeon Electronics Pvt. Ltd. B-257 Okhla Industrial Area, Phase-I New Delhi	20,000	Cassette tape recorders (Combination) (80% export)
66.	Mega Overseas Pvt Ltd, 1137 Chandni Chowk, Delhi	12,000	Cassette tape recorders (Combination) (80% export)
67.	Electronica Industries, (C.M. Sirkek) Complex Chambaghat, Solan (HP).	5,000	Casstte Tape recorders
68.	Mr Ram C. Chokhani, 34 Napean Sea Road, Bombay.	5,000	Cassette tape recorders
69.	Punjab State Electronics Development & Production Corpn. Ltd, 50 Sector IV, Chandigarh	5,000	Cassette tape recorders.
70.	Hindustan Radio & Electric Co. Jawahar Chowk, Jhansi.	5,000	
71.	Standard Radio Corporation, Near Krishna Cinema, 9 Hamidiya Road, Bhopal	5,000	
72.	Orient Electronics 49-A Industrial Estate, Barzalla, Srinagar	5,000	
73.	P. Obul Reddy, 31 General Patters Road, Madras.	5,000	Cassette tape recorders
74	Raj Radio Services Moh. Bhaisarure, Biharsharif, Nalanda, Bihar	5,000	
75.	Modern Electronics, C-1/2 Model Town, Delhi	5,000	
76.	Television Combine, Jhotwara, Jaipur	5,000	
77.	Video Electronics Pvt. Ltd., 75 Chandra Puri, Hapur Road, Ghaziabad	5,000	
78.	Lt. Col. J.D B. Gnanaolivu, HAL Road, Richards Town, Bangalore.	5,000	Tape recorders/ audio teachers
79.	Miki Electronics, P.B. No. 311, 2049/1, A-Block, M.C. Colony, P.J Extn, Devanagere, Karnataka.	5,000	
80.	Telerama (India) Ltd. 11 Sooterkin Street, Calcutta.	5,000	
81.	Sonodyne Electronics Co. Pvt. Ltd. 7 Sousin Roy Road, Calcutta.	5,000	
82.	Punjstar Standard Electronics Pvt. Ltd 303 Sector 10, Chandigarh.	5,000	
83.	The Himachal Pradesh Mineral & Industrial Development Corporation Limited Simla	5,000	
84.	Mr C.M. Sirkek, Electronics Industries P.O. Thanedhar, Dist Simla	33,000	Cassette tape recorders (9,050 export)

Courtesy: Department of Electronics.

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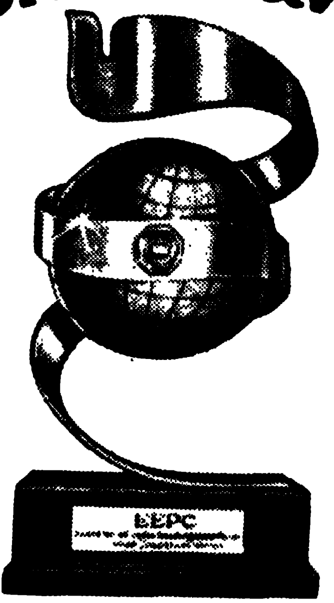

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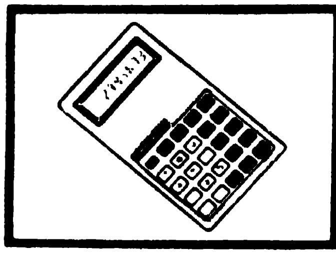

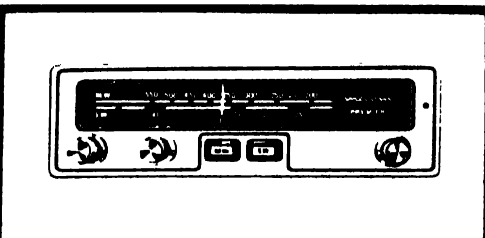

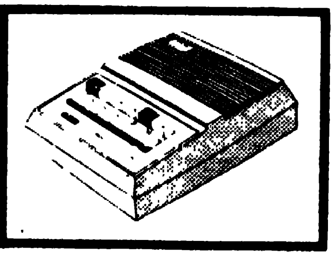

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BUDGET AND THE PLAN
(Electronics: 1978-79)

Ever since the dawn of planning in this country, the central budget of the government spells out every year the expenditure that is proposed to be incurred on the planned projects.

The central budget for 1978-79, for instance, has presented along with the budget documents, a special paper entitled 'Plan Budget.' It includes details about the schemes which are proposed to be financed from the plan outlay earmarked for 1978-79. It includes the projects exclusively dealing with telecommunications and electronics industries.

Listed below are the projects concerning the electronics industry which have been included in the Plan for 1978-79. Financial details have also been incorporated wherever available.

Department of Electronics (Rs 145.9 million)

The outlay is mainly for National Information centre (Rs 42.4 million); strengthening of Regional Computer Centre at Calcutta and installation of computers at the centres in Chandigarh, Kanpur, Lucknow and Patna (Rs 10 million); Standardisation and promotional schemes (Rs 9.9 million); financial support to other organisations for development of critical, strategic and specialised electronic components and materials (Rs 12.5 million); and development programmes, namely (i) technological development programmes of national importance (Rs 29.0 million), (ii) National Radar Council projects (Rs 18.4 million); and (iii) Defence projects (Rs 18.1 million).

Export Promotion (Rs 4.6 million)

This provision is mainly (Rs 4.1 million out of Rs 4.6 million) for the Santa Cruz Electronics Export Processing Zone.

Telecommunication and Electronics Industries (Rs 221.7 million)

The provision is mainly for Indian Telephone Industries Ltd (Rs 130.1 million, besides its extra-budgetary resources of Rs 35.0 million). Computer Maintenance Corporation (Rs 40.0 million) for taking over the maintenance of IBM machines by 1st June, 1978 consequent on the decision of IBM to wind up its activities in India, Complex for production and research and development of semi - conductor devices (Rs 30.0 million), Electronics Corporation of India (Rs 10.0 million, besides Rs 22.0 million available from its internal resources) for its expansion programme, Electronics Trade and Technology Development Corporation (Rs 5.0 million) for its seed money and working capital, Indian Telecommunication Construction Co Ltd (Rs 2.0 million) and Telecommunication Consultants (India) Ltd (Rs 1.0 million). The last two are new companies being set up—the former to undertake construction and installation of various telecommunication equipments for customers in India and abroad and the latter to provide technical and consultancy service in the field of telecommunications.

Posts & Telegraphs (Rs 281.4 million)

The Plan outlay of Rs 3126.3 million for Telecommunication Services (including Wireless) is for providing additional 210,000 lines switching equipment capacity, 250,000 telephone connections (including 192,000 direct exchange lines), 10,900 trunk automatic exchange lines, 20 STD routes, 662 manual trunk boards, 2,624 route kM of coaxial cables, 3,914 route kM of microwave systems, 1,230 route kM of UHF Schemes, 2300 telegraph offices and 2,000 long distance PCOs in villages with a population of 5,000 in ordinary areas and 2,500 in hilly and backward areas.

The Plan outlay of Rs 133.0 million for Postal Services is mainly for the construction of postal buildings, mechanisation of postal services and opening of new post offices in rural areas.

Against the total outlay of Rs 3,259.3 million, the internal resources generated are Rs 2,977.9 million and budgetary support is Rs 281.4 million.

Civil Aviation (Rs 196.3 million)

The outlay is mainly intended for the development of civil aerodromes, improvement of safety-oriented aeronautical communication services, and navigational facilites and installation of modern equipment to improve the services at aerodromes. There is also provision for budgetary support of Rs 30.4 million to the International Airports Authority of India.

Satellite Programme (Rs 228.4 million)

The provision is for space-segment of the Indian National Satellite (INSAT-I) System. INSAT is a multipurpose System covering three services, namely, telecommunications, television and meteorology. The Department of Space is responsible for the procurement and operation of the space-segment. The INSAT-I satellite is expected to be launched by December, 1980/January, 1981. The outlay during 1978-79 is mainly for anticipated payments for the space-craft and the Master Control Facility in addition to the expenditure on project management, consultancy and launch services.

Overseas Communications Service (Rs 115.4 million)

This includes provision mainly for satellite projects (Rs 30.0 million), switching programmes (Rs 49.9 million), Indo-USSR troposcatter link (Rs 7.5 million), IOCOM Cable project (Rs 5.0 million), payment of INTELSAT (Rs 5.0 million) and HF equipment and facilities (Rs 5.0 million) □

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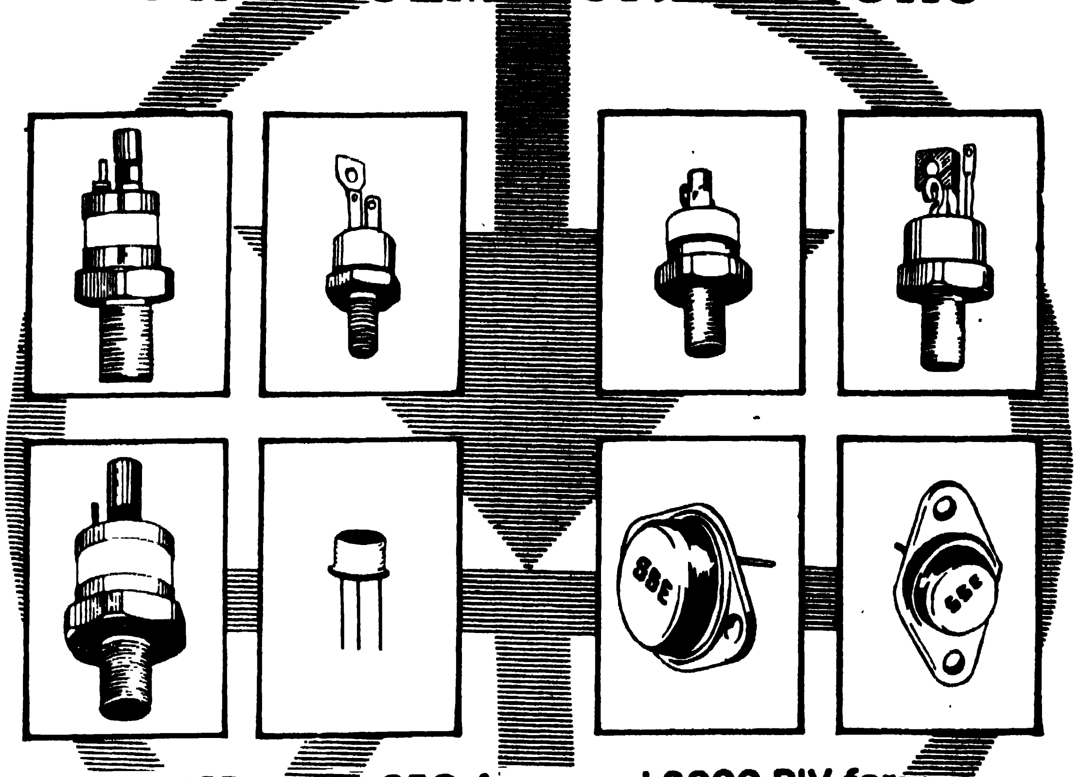

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Electronics in the Parliament

Several interesting questions concerning electronics came up in the Lok Sabha on March 15 and March 22, which were replied to by the Prime Minister, Mr Morarji Desai. Some of these questions and answers, except the last which was raised in Rajya Sabha, are being reproduced below:

Satellite for TV

Mr B.P. Mandal: Is it possible for our country to instal a satellite for TV programmes as was being done by the American statellite?

Prime Minister, Mr Morarji Desai: The government has approved establishment of an Indian National Satellite (INSAT) System by the end of first quarter of 1981. INSAT-I satellite will combine, with substantial telecommunications and meteorology service capabilities, a limited, though nation-wide, capability for direct TV broadcasting to augmented TV receivers in rural areas as experimentally demonstrated on a small scale during 1975-76 with United States ATS-6 satellite under SITE project.

Rise in Price of Components:

Mr M. Kalyana Sundram: Is it a fact that a multinational manufacturer of components of entertainment electronics has raised its prices; if so, the details thereof and the reaction of government thereto?

Prime Minister, Mr Morarji Desai: Yes, Sir. The Federation of Association of Small Scale Industries has brought to the government's notice that there has been an increase in the prices of electronic components manufactured by a multinational company.

As electronic components have not been declared essential commodities, the government has no control over their prices. However, sufficient industrial capacity has been licensed in this area; imports of these components are being arranged through Electronics Trade & Technology Development Corporation (ETTDC) to meet temporary shortages and as a buffer stock; and suitable endorsements are being given on the Actual Users' licences of electronic equipment manufacturers. It is expected that with these steps by government, market forces will work effectively to maintain the price level of these components.

Import of Computer Peripherals

Mr Ragavalu Mohanarangam: What's the policy regarding import of computer peripherals; the names of the large business houses which have been allowed to import and the quality and value of equipment so allowed to be imported; and the extent to which the public sector projects and small-scale industries have been affected as a result of this policy?

Prime Minister, Mr Morarji Desai: Import of computer peripherals is normally permitted to:

(i) Companies licensed/approved to make computer systems on the basis of their phased manufacturing programmes, as approved by government.

(ii) R & D institutions, to enable development of minicomputer/ microprocessor related technology in the country, and for achieving self-reliance in system engineering activities; and

(iii) Actual users (non-industrial) for augmenting their inhouse computing facilities, clearances being granted on the basis of assessed requirements.

Information regarding the large business houses allowed to import computer peripherals is being collected.

The government's policy regarding import of peripherals does not adversely affect public sector projects or small-scale industries. However, the extent to which the latter may have been affected by any imports, concerning which information is being collected as indicated, will be examined and reported.

Fee Charged by CMC

Dr V.A. Seyid Muhammed: Is the statement in the "Financial Express' dated February 7, 1978 that the Computer Maintenance Corporation is charging the IBM system users a fee three hundred per cent higher than the IBM fee true?

Prime Minister, Mr Morarji Desai: No, sir, the basis of costing is different and as such not comparable.

Assistance to IBM Employees

Mr Sukhdeo Prasad Verma: Is it a fact that the employees of erstwhile IBM have approached government to assist them to carry on the business so far conducted by the International Business Machine in the matter of running computer centres and card manufacturing business in four computing centres in India? And is it also a fact that at a recent meeting held between you and the multinational group a suggestion was made to government to allow the IBM to carry on the business without share dilution; and the facts thereof and steps being taken to protect the employment interest of a large number of Indian employees?

Prime Minister, Mr Morarji Desai: No, sir (erstwhile IBM employees did not approach the government).

In July 1977, IBM at their meeting with me outlined their proposals for continuing their business in India on the basis of no dilution of their equity. This was not acceptable to government and IBM then decided to phase out their business operations in India. The Computer Maintenance Corporation, a public sector company, has offered employment to all staff of the Customer Engineering Department of IBM, and a very large number of these employees have already accepted the offer.

Computer Production

Mr Sukhdeo Prasad Verma and Dr Vasant Kumar Pandit: Has the government's attention been drawn to the news item appearing in the 'Indian Express' dated February 20, 1978 under the caption "Computer Production Held Up"; if so, the reaction thereto and the efforts being made to expedite the process of production of computers in India, and also for action on the report submitted by an expert panel in this regard?

Prime Minister, Mr Morarji Desai: Yes, sir. One of the first initiatives the Department of Electronics took after the formation of the Electronics Commission in February 1971 was to provide substantial R & D finances to the public sector corporation, Electronics Corporation of India Ltd (ECIL) to develop the hardware and software for what have since become their TDC-312 and TDC-316 minicomputer programmes. Some 70 such minicomputers have been sold to date.

However, with a view of expanding and diversifying this base of minicomputers in the country, the Department of Electronics set up a panel on minicomputers in June 1972. The basic tasks assigned to the panel were: to identify the applications of minicomputers relevant to this country; to estimate, on the bais, the total demand for these machines and the peripheral units to go with them over the Fifth Plan period; and to design a strategy for their local manufacture. In their report submitted in September 1973, the panel made two major recommendations relating to the approach which should be followed in launching and building up the minicomputer industry in the country. First, due to our present level of economic, and particularly industrial development, and our overall socio-economic objectives, particularly with respect to employment generation, the type of minicomputers and their areas of application would need to be fundamentally different from those in the highly industrialised countries. Secondly, as computerisation in India was in its early stages, full advantage should be taken of the major technological developments in minicomputers and microprocessors which were occuring in the highly industrialised countries, particularly with reference to the type of manufacturing base which we set up.

However, at that time world technology relating to both processors and peripherals for minicomputers was in a state of flux. Therefore, the Department of Electronics felt that some stability in technology should emerge, before deciding the technological basis and industrial structure on which our minicomputer industry should be built.

Furthermore, September 1973 was also just the time when the country was hit by the oil crisis. The Department of Economic Affairs of the Finance Ministry, therefore, directed that the foreign exchange position was so tight that the greatest caution should be exercised before setting up new industries requiring large import content. The panel on minicomputers had estimated that the import content, covering both processors and peripherals, of a typical minicomputer system, would be about Rs 250,000 on an average. This meant that even a modest minicomputer programme involving an annual production of 200 minicomputer systems would have resulted in an annual foreign exchange drain of Rs 50 million. The magnitude of this foreign exchange outflow made it essential to build up considerable indigenous content before launching the minicomputer industry.

About 60-70% of the total cost of a typical minicomputer system consists of the peripherals. It was, therefore, assessed, that indigenous production capacity for at least a minimum range of peripherals should be set up before industrial licensing of minicomputer systems was initiated. Otherwise, industrial approvals for minicomputer 'manufacture' would result only in "kit assembly" on the basis of imported sub-systems, with all the deleterious effects that such kit assembly involves, e.g., high foreign exchange outflow, negligible local value added, lack of standardisation of processors and peripherals and an emphasis on hardware to the neglect of the software which is so important in that area.

About two years ago, the technology of miniperipherals came to stabilise, at which time the Department of Electronics initiated and financed R & D projects on the minimum range of peripherals in leading public sector companies and government laboratories and promoted similar development in-house among private sector companies in both the large and small scale sectors. Industrial licences for the manufacture of these peripherals were also issued soon afterwards, with the result that by June 1977 some 10 companies were geared to meet at least the initial peripheral requirements of the minicomputer industry. Thirdly, active promotional measures were taken by the Department to build up the software needed for the minicomputer industry. A fourth initiative to prepare industry to go into minicomputers in a meaningful manner, was to approve companies licensed to make electronic calculators, to diversify into microporocessor-based programmable calculators, cash registers and accounting and invoicing machines, which constitute an intermediate type of product to the minicomputers. This has borne positive results with several manufacturers having introduced such products into the market in the last 12-18 months.

Having taken all these steps to prepare the ground for launching the minicomputer industry on a viable basis, as recommended by the minicomputer panel, the Department of Electronics has recently taken the approval of the Electronics Commission to a comprehensive policy framework and operational procedures for initiating minicomputer production. Based on this approval, the policy of government for the development of the minicomputer industry will be announced shortly.

It may be pointed out that applications for minicomputer manufacture received in the past have been rejected/ closed as and when they came up for consideration, because of the need for great caution in launching this industry for the reasons set out above.

As regards the extent of minicomputer systems which have been imported in the last five years, only about 35 systems have been imported. Most of these systems were meant for highly specialised applications involving special software packages, and import has been resorted to only after detailed case by case scrutiny. What is more, they were systems offering higher capabilities than even the TDC-312 and TDC-316 minicomputers made by our leading computer manufacturer ECIL. None of these imports could have been avoided if the general minicomputer industry had been launched earlier.

Violation of Licensing Laws

Mr Vasant Sathe: Is it a fact that consumer electronics, audio equipment industry which has been nurtured and developed by the pioneering efforts of small-scale electronic units for years is now being dominated/ monopolised by the multinational companies, Philips India Ltd and Gramophone Company of India Ltd (HMV) by violating country's licensing laws and that these companies are repatriating huge funds by producing the items beyond their approved capacity; whether government has received complaints to this effect and if so, the important details thereof; and the action taken or proposed to be taken to protect the interests of small-scale units and check the monopoly malpractices by the dominant multinationals?

Prime Minister, Mr Morarji Desai: Philips (India) Ltd and Gramophone Company of India Ltd are manufacturing consumer electronics and audio equipment under and according to licence and consequently no violation of licensing laws is involved.

The manufacturers of amplifiers in the small-scale sector have, however, represented that the large-scale units manufacturing radios offer 'hi-fi' and stereo amplifiers as an integral part of the radios made by them and this practice is detrimental to the interests of the small-scale sector.

A 15 per cent differential excise duty has been in force since the Union Budget for 1977-78 to safeguard the interests of the small-scale sector.

Regional Office of Electronics Commission in Calcutta

Mr Chitta Basu: Is the government contemplating to set up a regional office of Electronics Commission in Calcutta for the benefit of Eastern and North Eastern regions; and if not, the reasons thereof?

Prime Minister, Mr Morarji Desai: The Information, Planning and Analysis Group of the Electronics Commission has a regional office in Calcutta which has been in operation since 1974

Restructuring of Electronics Commission

Mr Chitta Basu: Is the government contemplating to restructure the Electronics Commission with adequate representation from all States; and if not, the reasons thereof?

Prime Minister, Mr Morarji Desai: No, sir. The Electronics Commission is a compact body consisting of not less than four and not more than seven members, and the membership of the commission is on an individual and not on a representational basis. As such it is fulfilling the objective for which it was set up.

Imported TV Picture Tubes

Mr Bir Chandra Deb Burman, Mr Sanat Kumar Raha and Mr Jagjit Singh Anand: Is it a fact that the basis of distribution of imported TV picture tubes has been shifted from licensed capacity to production capacity since last year? Has the government been urged to revert to the earlier policy in this regard; and if so, what action has been taken in the matter?

Prime Minister, Mr Morarji Desai: No, Sir (there has been no shift).

Recently, some suggestions have been made to restrict the supply of imported picture tubes to large-scale units on the basis of their industrial licensed capacities and small-scale units on the basis of their approved capacities. Government is of the view that the current distribution policy based on actual requirements is working satisfactorily and achieving objective of ensuring adequate availability of picture tubes to the smaller manufacturers of TV sets and of effectively coordinating imports with domestic production of TV picture tubes. □

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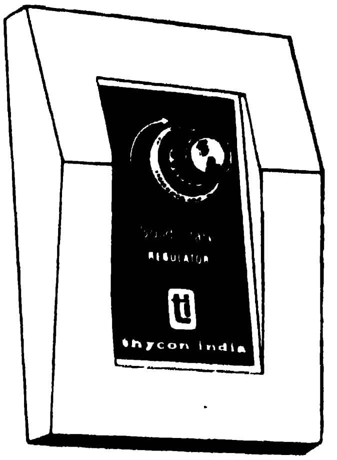

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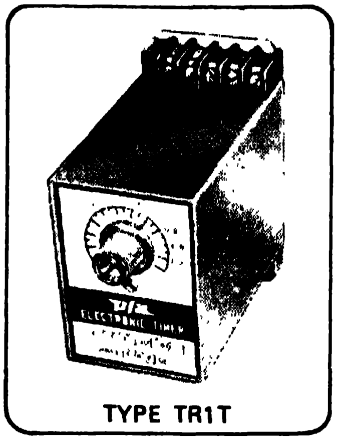

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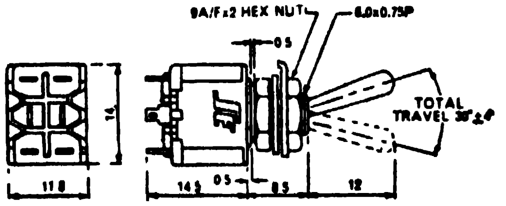
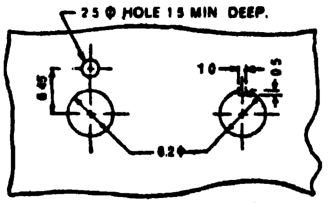


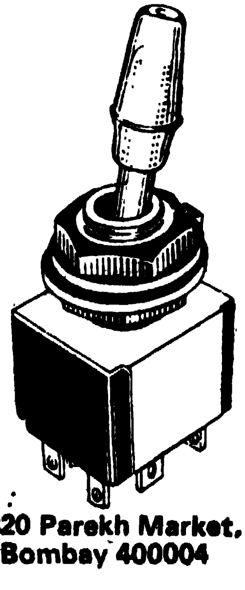
TOGGLE SWITCH MODEL-T 2A



RECOMMENDED PANEL CUT-OUT

SPECIFICATIONS

CIRCUITRY	Double Pole—Double throw
CURRENT RATING	: a) 2 amps. 250V A.C. 50 c/s b) 4 amps. 30V
CONTACT RESISTANCE	Below 10 milliohms
INSULATION RESISTANCE	500 Megohms (min)
LIFE EXPECTANCY	20,000 cycles/min. operation
ACCESSORIES	a) Coloured Plastic Caps for identification of controls b) Knurled mounting nut or Decorative mounting nut.



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Chandni Chowk, Delhi 110006

For Bombay region :
N.J. Electronics, 820 Parekh Market,
Lamington Road, Bombay 400004

Computer Techniques in the Soviet Union

M. Morozov

Today one can hardly find a field in Soviet science and technology where electronics does not play a major role. Machines, instruments, automated systems, computers, radio devices, artificial earth satellites, spaceships and medical equipment are inconceivable without electronics.

Computers of the first generation contained thousands of electronic valves. The limits of the development of electronics based on electronic valves were exhausted. The cause of this lay in the valve itself: its lifetime was 2000 hours. Therefore, the typical computer of the first generation, which contained 10,000 valves, often malfunctioned: each six minutes a valve went out of order. Besides, the equipment occupied an area of a large factory and consumed much energy.

The valve gave way to the durable transistor. The reliability of the computer of the second generation was six days. This term was accounted for by another factor. The lifetime of the transistor is millions of hours. However, the reliability of the system was limited by the low strength of the connections: the computer circuit had millions of various connections, mainly soldered which were the main cause of malfunctions.

Solving this problem, Soviet scientists chose the way of creating monolithic microelectronic circuits. Methods of processing the surface of the plate were designed which enabled the obtaining of other necessary elements of circuits on it—resistances, condensers, interconnections, etc.

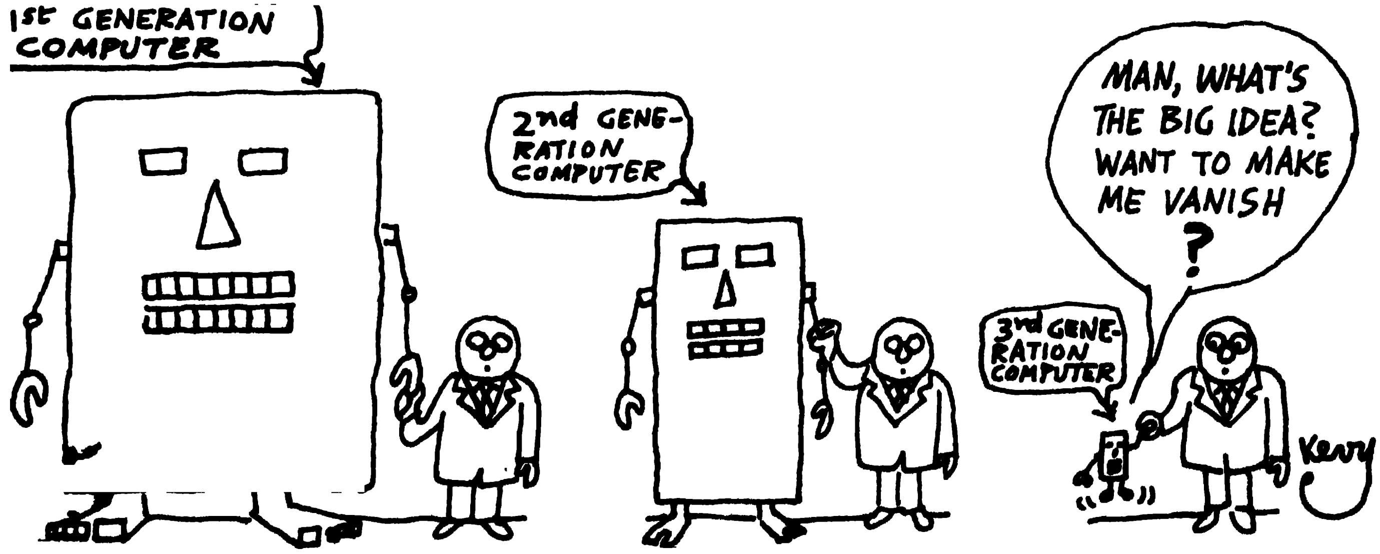
As a result, a whole group of components were placed on a single plate. These components, linked into a circuit, resembled a flat mosaic. If one adds that the pattern was very fine—half a micron (or 2000 lines per millimetre), it will become clear that only up-to-date technology could produce such a "mosaic panel." It is only beam equipment that can draw such fine patterns. An ion beam helps to drive several ions of the admixture to the needed depth into the plate.

A programming device controls the entire technological process. Man watches the process by the instruments and makes appropriate corrections.

The sophisticated computer of the third generation has a reliability of six months and consumes just about 100 watts of energy like an ordinary desk lamp. The machine's volume has decreased thousands of times (not a huge factory shop, but a bookshelf). The operation speed has risen 10,000 times. In other words, the number of operations performed by the first computer in three or four hours is carried out today in the matter of a second.

In the Soviet Union microelectronics is widely used now to perform the most important functions. It is used in computing centres, unique research instruments, onboard equipment of modern ships, planes and spacecraft, in controlling systems which regulate the operation of plants, traffic function and power grids.

For instance, the Soviet complex system watches day and night over the state of all key units of a power station, regulates operation modes to make them optimum, switches the equipment according to the preset programme, simultaneously tabulates the main parameters, and in the prescribed time the printer issues a document on all problems of interest for the controller.



Microelectronics is also extensively applied in medicine. For instance, to study a stomach a radio pill has been created in the USSR. This pill, which is like a bean in size, houses acidity and temperature sensors and a radio set. The patient swallows the pill, and the doctor traces its passage, looking at some instruments and deciphers the message, watching other devices. Thus, the opportunity has appeared to create a tiny radio controlled capsule, which floats through blood vessels to the heart, studies its chambers and valves and reports the results of the survey.

Monolithic circuits mentioned above are not the only type of integrated circuits There are also film and hybrid circuits. The amount of information which grows with every day calls for the creation of new materials for its recording and storage. The conventional photographic plate and photographic film do not already meet the growing needs of present-day technology. Today materials are needed which do not require development and which permit people to promptly record and erase the image. These conditions are met by Ftiros —new film material created by Soviet scientists. They have found the method of evolving film structures in which changes in optical properties of vanadium oxides are vividly manifested. The slight heating of this structure (up to 50-70 degrees centigrade above zero) brings about a sharp change of its colour. Within a time limit of less than a millionth of a second any transformation of the colour is achieved practically in the whole range of the spectrum.

The new material has very high resolving power: several thousand alternating colour patches can be recorded on a millimetre-long film. If the film is slightly heated (without reaching the temperature of the phase transition) the record obtained will be preserved as long as necessary. To erase the record it is sufficient to slightly cool the film.

It is possible to record on Ftiros signals from a laser or a conventional source of light by an electron beam or simply by a heated source object. The new material is employed in indicators, in various digital and lettered panels. Such indicators are already used in watch-making. Ftiros is widely applied in holography too. The enormous speed of the change of holographic frame—of the order of 100,000 per second—makes it possible to record fast processes, for instance, to trace the dynamics of the development of gas flows or to control parts on a high-speed conveyer. The possibility of using Ftiros for the screens of cathode-ray tubes has been proved. Such tubes are needed to put information into optical computers—a new generation of computers.

The implicity of technology is one of the main merits of the material. Its manufacture needs no super-clean materials or too costly installations. This explains the low cost and the mass character of Ftiros, which is of particular importance due to its unique longevity.

Within the next few years the designers of computers are to solve a qualitatively new problem—to work out a model of a computer of the fourth generation. These machines will have the main properties of the best samples of the computer of the third generation, but their size will be 67-75 per cent smaller and will learn to fully remove their malfunctions. Soviet specialists are working on new computers (for instance, the EC-1868 with a capcity of about 1.5 million operations per second) and on the improvement of the process of computer manufacture. The Minsk Computer Plant has decided to abandon the conveyer method of assembly because the probability of errors was too great and the production rates were hindered. For instance, the frame—one of the most labour-consuming elements—has about 5000 connections. An assembly man had to conduct complicated calculations, each time finding the necessary pin. Now in the frame section the serial assembly is done with the aid of an automated control system. The computer guides the assembly man. If the assembly man wrongly chooses the wire and tries to connect it, the indicator lamp immediately flashes up. In a word, today the computer works for itself.

The creation of the Nairi-4 small computer was a great success of Soviet designers. The so-called micro-assemblages are used in it with a high degree of integration which made it possible to radically reduce the size and to enhance the computer's reliability. Finally, a memory on cylindrical magnetic films of a new type has been worked out for the Nairi-4.

Soviet scientists have had to solve not only purely technological problems; they also faced the dilemma: either to create an all-purpose machine, as previously, or to follow the road of specialisation. The "golden mean" was chosen. The new computer is fitted for problem - orientation. In other words, its structure and performance allow the user to tune the machine to a concrete problem: for instance, problems of the automation of the designer's workplace, or control over the quality of radio electronic equipment or control over technological processes or air traffic at a large airport.

The Nairi-4 belongs to the class of small computers which are increasingly applied in various sectors of the Soviet economy, in Soviet science and technology. It can perform about 500,000 operations per second. The capacity of its internal storage is 64,000 alpha-digital symbols. The computer is linked with the outside world by a trunk channel with a capacity of up to 30 million bits. The channel makes it possible to simultaneously connect a large number of various devices to the machine.

Monolithic, film and hybrid integrated circuits are developing simultaneously. They are used in a comprehensive way, and the spheres of their application grow with each passing year. ☐

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COBOL PROGRAMMING (Part 5)

R. Ramaswamy and T. V. Krishnamurthy

We have said that to get a full picture of the structure of a Cobol program we have to make frequent excursions to the three major divisions, namely, the environment division, the data division and the procedure division. Now it is time for us to look into some details in the data division.

Data division

Any operational instruction given in the procedure division invariably refers to some data. Unless all the data have been completely described in the data division, they cannot be used in the procedure division. When one describes a data in the data division, immediately space is allocated in the computer memory as per the data description. Cobol requires prior allocation of memory space for all the data items and working areas. In Fortran, if we write

X = A + B

immediately a storage X is created in the memory and the value obtained by adding A and B is stored in the memory. In Cobol the above operational instruction is written in the procedure division as

COMPUTE X = A + B
or ADD A B GIVING X

When it is written as above, the storage X is not created in the memory as in Fortran. The notations X, A and B must have been previously defined in the data division and the storage must have been reserved already. In summary, we can say that every data name that occurs in the procedure division must have been described in the data division earlier. So it is clear why the data division precedes the procedure division in a Cobol program.

We have said that any manipulation of data in the procedure division can take place only if the data space has been reserved in the data division and the relevant data entered there. This means that the computer cannot be instructed to read the data directly into the working area from the punched cards for manipulation purposes. First of all the input data must be written in the memory in the allocated space and then they must be taken to the working area. After processing, the output data cannot be directly transferred from the working area to the printer. The output data must be transferred to an allocated space in the memory and then transferred to the printer from the memory. In Fortran data can be directly read into the working area and the output directly taken to the printer from the working area. This is called 'load and go processing.' Cobol is not intended for such 'load and go processing.' So Cobol formalisms are more elaborate than Fortran.

Data structure

When we have a large number of data belonging to a particular group, we can give each data a different name to distinguish them. A convenient practice is to give a common name for the group and distinguish the different data by using different subscripts to the common name. For example, A(1), A(2), A(3), ...A(n) represent the data names in an array or group called A. This group contains 'n' data names. Data names can also be represented by using double subscripts such as A(1, 1), A(1, 2), A(1, 3) etc. This is how we do in Fortran. Mere representation of data in one-dimensional or in two-dimensional arrays do not tell us anything about the relationship between the different data items. Each element of the array has an independent status and has no hierarchial structure in that array. In business and commercial problems, we need to know the structural relationship between the different data items for effective processing. Cobol language provides for this facility by establishing a hierarchial structure for data. We call this organisation of data in Cobol as Cobol File or simply a File.

The name file signifies almost the same meaning as the file maintained in any organisation. Suppose one wants to prepare the pay cheque for all the employees in a firm, the cashier gets the necessary data from a file called the payroll file. The payroll file contains information about each employee, his status, basic salary, different allowances, different deductions etc. The information relating to each employee is called a record. The collection of such records is a Cobol file. For example, there may be a data record for each employee called by some name, say, Employee-pay-record written on each page of a ledger. This record may give the employee number, name, daily wages, days worked, allowances, deductions etc, somewhat as shown below:

Page-1 **Page-2** **Page-3**

Employee No.
Name .
Status .
Daily Wages .
Days Worked.
Allowances .
Deducations .

Each page of the ledger can contain details about an employee, as shown above. Each page will constitute a record. The collection of related records constitutes a file. The ledger book is equivalent to a file. The details in each record are also related items called data items. Hence a

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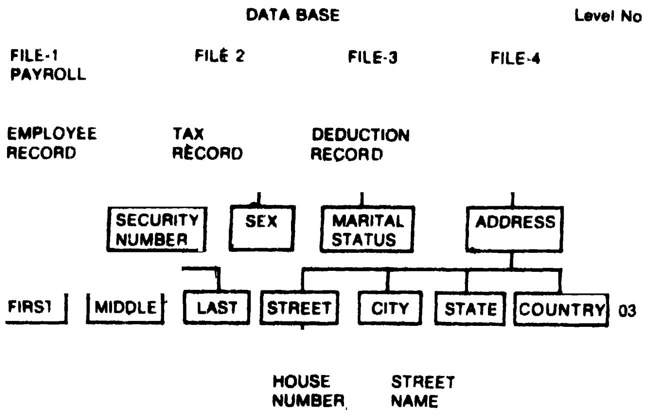
This is the fifth part of a serial being published regularly since January 1978.

record is a collection of related data items.

The records in a file are usually organised so that any individual record may be retrieved. Hence they are arranged in sequence, based on some key item in the records. For example, the employee number can be a key item for identification of personal records and they can be arranged in an ascending order. The records can also be arranged in an alphabetic order of names.

Just as we can have different ledgers for keeping the different records, we can have different files for keeping the different records, say stock inventory, medical records, insurance policy etc. A collection of files is called the data base. The purpose of file organisation is to get the appropriate information at the appropriate time with minimum of time delay from the volumes of files. The Cobol data base organisation with its hierarchial structure of data is able to achieve this task very efficiently.

Data simply means recorded information. Consider an employee record containing information like his name, sex, marital status and address. Then we say that the employee record is a group item containing a number of data items. Take the data item relating to the sex. This data item cannot be further subdivided. We call such data items as elementary data items. Consider the data item relating to the address. This can be further subdivided into data items which give the name of the city, street, house number etc. We call the data item, address, as a group data item. We can consider the relationship between the group data and its consitutents by a structure somewhat as shown below:



The hierarchy of the different data are represented by certain numbers called the level numbers. The deeper the data item, the higher is the level number assigned.

The file is the broadest category of data and is assigned the highest level in the hierarchy. It is given the name FD to set it apart from the other organisational levels. Records, the next broadest category, are always assigned the level number 01. Data groups and elements within records may be assigned any level number from 02 to 49. Data elements independent of one another should be assigned the same level number. Elements belonging to a group should be assigned a level number larger than that assigned to the group name. In terms of the above description the level numbers of the different data items in the data structure diagram are written as follows:

```
FD FILE-1
01 EMPLOYEE-RECORD
02 NAME
  03 FIRST
  03 MIDDLE
  03 LAST
02 SECURITY NUMBER
02 SEX
02 MARITAL STATUS
02 ADDRESS
  03 STREET
     04 HOUSE NUMBER
     04 STREET NAME
   03 CITY
   03 STATE
   03 COUNTRY
```

The structure of data with the level concept enables the programmer to refer to individual elementary item or group item by name. Whenever a 01 level record is referred, all the items within the record are immediately available. This is a great advantage for input and output.

Special level numbers

In addition to the level numbers in the range 01 to 49 for representing data structure, there are two special level numbers 77 and 88. Data elements which do not belong to any data organisation or the so-called independent data elements are assigned the level number 77. These data elements occur at the working storage area and they are not further subdivided. The level number 77 is written in the A-margin. Certain conditionals may require a value to be assigned to each possible alternative and that each alternative be given a name in the data division. When this occurs, the condition names are given the special level number 88. The meaning of the two levels will become clear when we consider an actual program using them.

Cobol data symbols

Cobol data are of three types, namely, alphabetic, numeric and alphanumeric. The data fields belonging to the above data classes are described symbolically by the letters A, 9 and X respectively.

Numeric data

When the data is numeric, each digit is represented by the letter 9, so that an item of four digits would be described as

```
    PICTURE 9999
or  PIC 9999
```

It is not necessary to write a string of 9's, and the same can be written in a compact form as

PIC 9(4)

Any four-digit number will be described by the above picture clause. For example, PIC 9(4) can represent a number 2345 or 3456 or 5678, and so on. If there are less than four digits in the number, the number is stored in the memory as 0023, in case the number happens to be 23. If the number is signed, the letter 'S' is put before the leading '9' which defines the numeric field. For example, the caluse

PIC S9(4)

can represent a number -2345. The 'S' character is said to indicate the position of an assumed sign. 'Assumed' means that the indicator sign 'S' is not written as part of the field and is not therefore counted in the length of the data item. The definition of a four character signed numeric data item would therefore appear as

PIC S9(4)

The use of assumed sign does not affect the positive numbers. For example, the value 2345 stored at a field described by the clause PIC S9(4) will be stored only as 2345.

A decimal point is indicated by the letter 'V' at the appropriate place. The 'V' character also indicates the position of an assumed decimal point. A number 23.45 will be punched in the card as 2345 but the location of the decimal point is indicated to the computer by the picture clause written as

PIC 99V99

It must be noted that a numerical field can contain only the digits 0 to 9. Blanks are not numeric characters. When punching data on cards, one should be careful to zero-fill a field with leading zeros, otherwise one may be in for surprising results. Thus in a field of six positions, the numeric 234 should be punched as 000234.

For punched card data that are to be processed by use of a Cobol program, any negative number is so identified by punching the negative sign over the rightmost digit by multipunching. This means that when you punch the rightmost digit, you depress the MULTIPUNCH key and punch both the desired digit and '—' sign in the same card column. This corroborates that the sign does not take up an extra position in computer memory.

The following exaples show how the different numbers are stored in the memory against the different descriptions.

Description	*Numeric value*	*Represented in storage as*
PIC S9999V99	167.89	016789
PIC S9999V99	- 1234.56	$12345\bar{6}$
PIC S9(4)V99	- 0.10	$00001\bar{0}$
PIC 9(6)	3456	003456
PIC S9(6)V999	- 234.178	$00023417\bar{8}$

Assumed sign and decimal point indicators are used for representing the input data which are to be used for further computation. But for outputing the results the actual signs and decimal points should be present, i.e. the output data must be edited for better presentation. Editing of data may involve suppression of zeros, insertion of comma, sign and decimal points. If the editing symbols are used in the input data which are to be used for manipulation, the computer will give error message.

Editing of data

Data items that will be printed need editing so that they will be more meaningful. Editing is generally required for numerical data. Sometimes editing is done for alphanumeric data also For this purpose, additional signs and symbols are required. Z, , B, ., +, , .$ are some of the edit symbols and signs that are used in Cobol.

Z edit symbol

The Z character is used for suppressing zeros in leading positions in a numeric field. The letter Z is placed in positions where zeros are to be replaced by blank spaces. The following examples will illustrate the use of Z edit symbol.

Actual Item	*Picture*	*Printed as*
04567	Z9999	4567
00567	ZZ999	567

Suppose we insert more number of Z characters than there are leading zeros, we say the Z character is floated. Floating Z will not affect any other numeral, nor will it suppress zeros which are in significant positions. The following examples will illustrate the use of floating Z picture.

Actual Item	*Picture*	*Printed as*
04567	ZZZZ9	4567
040067	ZZZZZ9	40067
00000067	ZZZZZZZZ	67
00670	ZZZZZ	670
4567	ZZZ9	4567

Note: Z must never be preceded by a 9, B or 0 (zero) in the picture.

Period (.) edit symbol

We have said that the use of V in the picture description indicates the presence of assumed decimal point in the data. Such data can be used only for computational purposes. If such data have to be displayed or printed, the actual decimal point must be indicated after the letter V. If we write the picture without the decimal point we will get an erroneous result. For example, if we give a picture 999V99 for outputting a value 12.32, we will get the printout as 01232. But if we give the format as 999V.99 the value will be printed as 012.32. If we give the picture ZZZ9V.99, we will get the printout as 12.32 Hence in a numeric field where the decimal fraction is to be distinguished from integers, the period is inserted in the appropriate place after the position of the assumed decimal point indicated by the letter V.

It may be noted that the (.) sign inserted takes one location and so it must be counted for finding the field width, even though the letter V is not counted for field. If we don't put the V operator in front of the decimal point, the printed result will be erroneous. For example, if we give a picture 99.99 for printing a value 12.32, the result will be 00.12. This appears somewhat surprising. But this is so, because, as per the picture clause there is no fractional part in the number in the absence of any decimal point operator 'V'. The period does not signify the position of a decimal point, but only that a period has to be inserted after the first two characters. Looking at the contents, as no reference to the fractional part is made, the computer will treat the value as integer 0012 (total 5 characters made of four 9's and one decimal point) and insert a period after the first two characters, outputting the result as 00.12. So in order to get the correct output, the format must be written as PIC 99V.99. This will cause the printing of the output as 12.32.

Suppose a data like the day (DD), month (MM) and year (YYYY) is to be printed as DD.MM.YYY, we have to insert two periods in the picture format as PIC. XX.XX.XXXX. Putting a V operator in the above case will be absurd. There cannot be more than one V operator in a number. A data 12111977 will be output as 12.11.1977 in the above picture format. It must be noted that a V operator is used only for numeric fields and for alphanumeric fields the V operator is not used.

The following examples will illustrate the use of period edit symbol in numeric fields.*

Data item	*Picture*	*Printed as*
23456	99V.999	23.456
13.2	PIC ZZZV.9	13.2
0.10	PIC ZZZV.99	.10

B edit symbol

This is an insertion character resulting in blanks being created in the designated positions. To print a name RRSWAMY as R. R. Swamy, we can give the output format as PIC X. BX. BXXXXX. The period edit will give the periods after the letters R and R. The B edit will give the blank spaces in the two required positions. Thus the output becomes more meaningful. Suppose we want to give the day, month and year as 12 11 1977 in the output, we can give a PICTURE XXBXXBXXXX. The B edit symbol can be used with both numeric and alphanumeric fields.

Comma (,) edit symbol

This is used to insert a comma wherever desired in numeric as well as alphanumeric fields. The following examples will illustrate the use of the comma edit.

Actual value	*Edit picture*	*Printed as*
2345.72	ZZZ99V.99	2345.72
2345.72	ZZ, Z99V.99	2,345.72
2345.72	Z, ZZ, Z99V.99	2,345.72

It may be noted from the above that a comma is inserted at any desired position, but when it is used in conjunction with Z edit symbol, a comma is inserted only after the first significant digit is printed. In the last example, even though there are two commas in the Picture clause, there is only one comma in the output, since the first significant digit (non-zero) is encountered only after the position of the first comma. So the first comma is ignored and only the second comma is inserted. However, if the value is 234572.72 the above-mentioned picture will give the output as 2,34,572.72. The two commas are inserted in the proper positions. Since the comma edit symbol occupies a location, it must be counted for the field length.

Plus and minus (+ & –) edit symbols

Suppose one wants to insert a – sign before a negative number or a + sign before a positive number, the appropriate signs can be placed in the output picture The – Picture insertion character differs from the S character in that the use of the S character identifies a field as a signed one for computational purposes, but the sign does not occupy a position as such. The use of + and – edit symbols occupy a character position and hence must be counted for field length. The + and – signs can also be floated just like the Zedit symbol. This means that the leading zeros will be automatically suppressed if there are more number of + or – symbols. The following examples will illustrate their use:

Actual item	*Edit Picture*	*Printed as*
– 123.47	– 999V.99	– 123.47
– 123.47	– – – 9V.99	– 123.47
1.28	– – – 9V.99	1.28
– 1.28	– – – 9V.99	– 1.28
+ 1.28	– – – 9V.99	+ 1.28
1.28	999V.99 +	001.28 +
1.28	999V.99–	001.28
0.0	+ + + +	bbbbbb
– 13	+ + + +	bbb-13

It may be noted that the + and – signs may be placed as first or last characters of Picture. When a – sign is placed for a positive number or zero, the space will be left blank. Of course, the – sign will appear in the printout if the number is negative.

Dollar ($) edit symbol

The $ insertion can be done at the desired position by using the sign in the picture code. Since the $ sign is counted in the field size, the field should be assigned at least one more position than the maximum number of significant digits expected. The $ sign may also be floated, by which we mean that it will not necessarily be entered in the leftmost position of a field but will be entered to the left of the first significant digit in the field and be preceded by blanks.

Suppose we have an editing picture clause as PIC

---

*Though this format is required for ICL 1900 series machines, the V operator is not required for IBM 360 series machines.

$$$999, the computer looks at the data and checks whether there is any zero in the leftmost position. If it is zero, the next digit is examined. If this next digit is not zero, the $ sign is inserted directly to the left of it. For the above clause the $ sign can be in any one of the first three positions according to the value stored in the field. The following examples illustrate the use of the $ picture insertion character.

Actual item	*Edit Picture*	*Printed as*
234.56	$99V.99	$234.56
100	$999999	$000100
100	$$$$$$9	$100
0023	$ZZ99	$23

One must be careful if one uses a combination of the different floating edit symbols. Since $, + or signs are mutually exclusive as floating, if we want to have both float and + or – sign, we write the + or the – sign to the right of the field as $$$$999 –. This picture will output a value 234 as $234-.

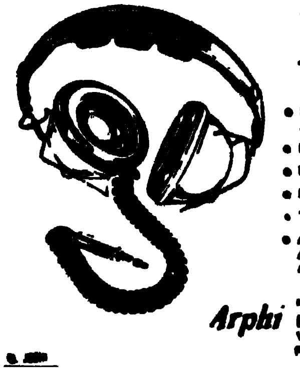
Since the list of editing symbols available will vary slightly from computer to computer, it is advisable to refer to that manual at the computing center for the complete list of editing symbols.

Alphabetic and alphanumeric data

An item containing only alphabetic characters can be described by using the 'A' picture code. For example, the clause written as PIC A(6) may represent a name with six alphabets, say, KRISHNA, If the item contains both alphabetic and other characters, X can be used in the picture code. For example, the clause written as PIC X(6) may represent a name O'NEAL. Note that the names like O'NEAL do not contain only alphabetic characters. When the field width is more, the data items in the A and X picturers are left justified. When the field width is less, the data items are truncated on the left side. The following examples illustrate the use of A and X pictures.

Data Value	*Picture code*	*Printed as*
DIODE	PIC A(5)	DIODE
TUBE	PIC X (5)	TUBEB
A-B-C	PIC X(4)	-B-C

To be continued next month



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Clearance Sale

50% off on Previous Annuals

Some copies of EFY's Annual Number 1977 and Annual Number 1976 are left in our stocks

Those who desire to have copies of these bumper issues can have them at half price, till the stocks last.

		1976 Annual	**1977 Annual**
Discounted price	:	Rs 7.50	Rs 10.00
Original price	:	Rs 15.00	Rs 20.00
Number of pages	:	304	316
Contents	:	Articles Who's Who Company Profiles Directory Buyers' Guide Facts & Figures	Articles Who's Who Company Profiles Directory Buyers' Guide Facts & Figures

Payment has to be made strictly in advance. No requests for VPP please. Full amount will be refunded if the stocks exhaust in the meanwhile.

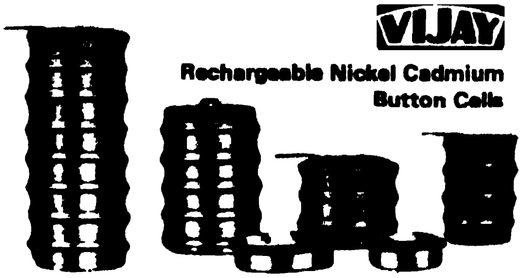
Postage will be borne by Electronics For You for these two annual issues.

The current Annual Number 1978 is available for Rs 20, plus Rs 2 for despatch by registered post.

—Circulation Manager

Attention
Electronic equipment
Manufacturers
Now available indegeniously

VIJAY
Rechargeable Nickel Cadmium
Button Cells



- No Vent, No leaking problem.
- Completely Sealed steel body.
- Single or in Stacked form upto 12 volts.
- Capacity ranging from 150 M.A.h. to 1 A h.

Manufactured by **CELLS INDIA**
C-14 MARUDHAR INDUSTRIAL AREA, BASNI
JODHPUR-342005 Ph : 20069
Apply for distributorship in unrepresented Areas.

Distributors for Rajasthan, M P & Gujrat M/s Goodwill Enterprise, Inside Jalori Gate, Jodhpur 342001. for Karnataka M/s Sudha Industrial Combines, 1693, 3rd Cross Road, Ramohanapuram, Bangalore 560021. for Delhi, Punjab, Haryana, Chandigarh, H.P & U P M/s Usha Communications Pvt Ltd, Plaza Cinema Building, Connaught Place New Delhi-110001

Metallized Polyester Capacitors
Mfrs : Transolar Components, Madras.

Types available

Rady Kap	:	P.P. Can, Radial lead
Poly Kap	:	Polyester tape, Axial lead
Plasti Kap and Box Kap	:	Special types, P.P. Can aluminium Can and RC Units.

D C. Voltage	Capacitance range
100	0.47 to 10. 0 MF
250	0.01 to 10.0 MF
400	0.01 to 2.2 MF
630	0.01 to 0.47 MF

For Bombay region

Smeeta Trading Co,
Hauman Building,
Chunam lane,
Lammington Road,
Bombay-400007.

N.J. Electronics,
820, Parekh Market,
39, Kennedy Bridge,
Bombay-400004.

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Electrolytic Capacitors for Radios, TV, Defence & Communications
0.47 mfd to 10,000 mfd
WORKING VOLTAGE 6V TO 100V

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Delhi : 273453 Hyderabad : 43036 Madras : 85904

Wanted:
Technical Penpushers

EFY is on the lookout for people who have the knack to simplify (not over-) technical matters so that these can be understood by a larger cross-section of readers, people who can write from their own experiences, people who (really) have something to say.

The articles may be constructional, practical or those having some application in industry, trade, education or R&D.

Honorarium will, of course, be paid for such articles at the normal rates.

—*Managing Editor*

CIRCUIT IDEAS

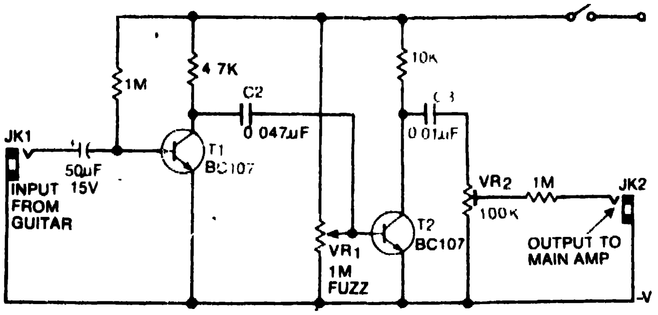
Fuzz Unit

The fuzz effect is a weird musical sound which is very much in use with the latest Pop groups. The fuzz boxes available in the market are quite expensive and may cost around Rs 300. The circuit given here is of a very economical fuzz unit, and should cost about Rs 50 only.

As seen from the diagram, the fuzz unit is a two-stage amplifier. The input from an electric guitar is fed to the base of T1 and then passed on to the base of T2 for further amplification. The second stage acts as an over - driven amplifier which clips and distorts the input audio signal. This produces the 'fuzz' effect.

The potentiometer VR1 is connected to exercise some control over the 'quality' of fuzz; VR1 varies the bias on the base of T2. The preset VR2 is incorporated to work as a variable attenuator so as to prevent overloading of the main amplifier. The main guitar amplifier could be permanently damaged if the output from the fuzz unit was too high.

A certain amount of treble boost is provided by the capacitors C2 and C3, which is a desirable effect with the fuzz effect. If more treble is desired, the values of capacitors C2 and C3 may be reduced.



Please note:

1 All the resistors are ¼W, 10% rated
2 VR1 is 1 megohm lin. or log. pot with switch
3 VR2 is 100 kilohm skeleton pre-set
4. JK1, JK2 are input and output jacks
5. Screened wire should be used at the input and output jacks to avoid undersirable noise pick-up

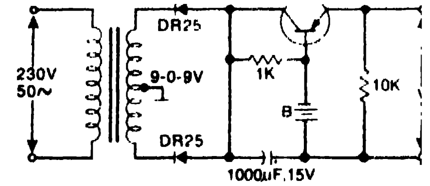
The fuzz unit is generally used with a lead guitar, but it can also be used with electronic organs, bass guitars, and even microphones.

A small 9V battery is recommended though any adequate power source may be used.

ASHOK K. DOCTOR

Regulated Power Supply with Automatic Battery Switching

A majority of the transistor receivers now available in the market operate with a battery voltage of 3, 4.5, 6 or 9 volt.



For required output voltage V, the appropriate battery B is required as follows

V(Output Voltage)	B (Battery Voltage)
2 9	3 0
4 4	4 5
5 9	6 0
	9 0

These receivers are operated most of the time inside the house and, therefore, a battery eliminator which can supply the required voltage working from the main supply, is a desirable accessary to the transistor receiver.

Here is a simple regulated power supply with automatic battery switching. The principal advantage of this ciruicit is the automatic takeover of load by battery whenever mains fail. In this, in order to overcome the large variation of output voltage, either with the mains voltage fluctuations or with the load current swings, a dry cell battery is used as a source of reference voltage.

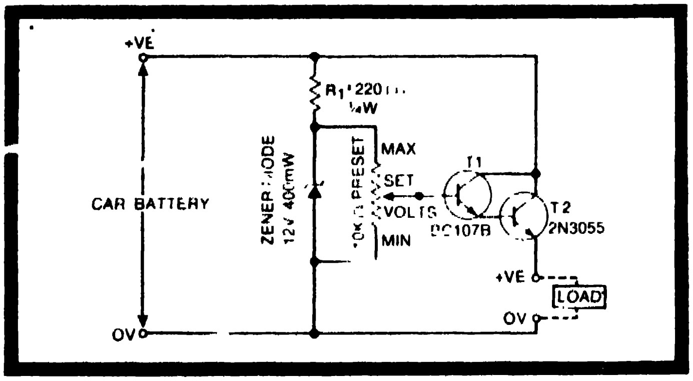
Since, in this circuit a dry-cell battery of required voltage is used as the reference, it provides a stable output with very good regulation. The regulation is of the order of 1% for a load current variation form 25 mA to 250 mA; and the output ripple voltage is not more than a millivolt.

LALIT KUMAR RANPURIA

Circuit to Run Tape Recorder in a Car

Here is a circuit, in response to Mr R. Gupta's request (under letters in EFY March '78 issue), to run cassette tape recorder in a car. It can also be used as a continuously variable 0-11V DC source. The circuit is cheap and uses very few parts, and can be adjusted for any cassette recorder. But it does not have any short-circuit protection.

The resistance R1 limits the current through the zener diode. The zener voltage appears across the potentiometer and does not vary with the battery voltage, as long as it is above 12V. The required voltage is tapped off and fed to the base of the T1-T2 Darlington pair configuration. This voltage minus the base emitter drop appears across the load. The circuit shown will deliver over 1 amp at any voltage within the specified range, and this should be more than enough for any cassette recorder.



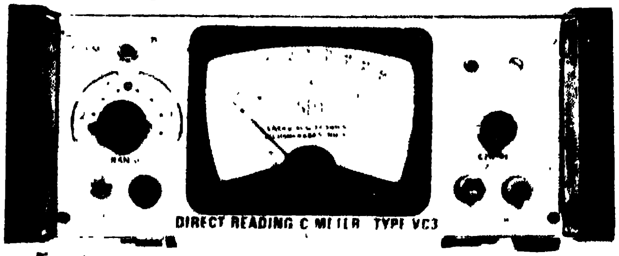
For setting up, the potentiometer is first put in the minimum position and the load is applied. The potentiometer is then adjusted for the required voltage.

The zener diode is used instead of a simple potential divider to enable the voltage to be fixed even when the car is speeding. (Ed: Please note the similarity of this circuit with the circuit for use with positive ground vehicles published on page 33 . . . .)

DINYAR CONTRACTOR

Vasavi introduces one more instrument:

Direct Reading Capacitance Meter



Features

- Direct measurement of capacitance.
- Percentage deviation from a standard possible.
- Both mains and battery operation with changeover facility (automatic).
- Large range of 3 microfared.
- Low cost.

For details contact:

VASAVI ELECTRONICS

Plot 162, Vasavi Co-op. Housing Society
Kakaguda, Secunderabad 500015. (Phone: 70995)

Some Facts

When it comes to advertising electronic products, there is nothing to beat ELECTRONICS FOR YOU. This is a proven fact, well known to the EFY's regular advertisers.

Why?

1. Because this is India's most popular electronics magazine and is being read by almost every one in India who is interested in electronics.

2. EFY now enjoys the largest circulation among electronics journals brought out in India. Not only is it being subscribed to by a very large number of companies, institutes, schools & colleges, public libraries and individuals, it is also being sold through prominent bookstalls all over India.

3. It offers the best of reading material. This magazine, therefore, not only 'goes' to its readers, but is 'read' by them.

4. EFY is now printed by offset process. It means you do not have to spend a paisa on blocks, matrices or stereos, and you can be sure of a good reproduction of your advertisement.

5. Unlike a local newspaper, it makes your advertised products known all over the country, and at a much less cost per 'interested' reader too!

6. Since this magazine is referred to repeatedly by the readers, your advertisements in EFY serve as constant reminders to the readers.

Advertising in ELECTRONICS FOR YOU really pays. Try it yourself!

COMPANY PROFILES

Philips: Profits Up

Sales of Philips India Ltd, including exports, increased from Rs 720.8 million in 1976 to Rs 798.1 million in 1977. The exports increased from Rs 47 million to Rs 49.2 million. Exports of lamps and radios continued to occupy a predominent position. Increases were achieved in exports of multimeters and electrodes as well as cassette recorders.

The profit for the year before tax was Rs 90.8 million compared to Rs 68.5 million in 1976. Provision for tax is 53.5 million as against Rs 43.5 million last year, leaving a profit after tax of Rs 37.3 million which was Rs 25.0 million in 1976.

In accordance with the approval of the Controller of Capital Issues 2,716,000 shares of Rs 10 each have been allotted on March 28, 1978, as fully paid up bonus shares in the ratio of one share for every five shares held by capitalising the share premium and a part of the general reserve. The directors have recommended a final dividend of Rs 0.80 per share on the increased capital of Rs 163.0 million, subject to deduction of tax. This, together with the interim dividend of Rs 0.50 per share, declared by the board of directors in December 1977, will make a total gross distribution of Rs 19.8 million as compared to Rs 16.3 million for 1976.

The increase in the market for television sets and radio sets in the country has resulted in higher demand for components. In certain areas it is apprehended that the present installed capacity will not be able to meet the growing demand of these markets and shortages may occur.

The radio market showed a growth over 1976. In the field of record playing equipment the company launched the first Indian made hi-fi stereo turntable. This electronic turntable will fill the gap in high-power stereo systems, so far met by imports.

The production of cassette recorders is as planned and the company has successfully exported 40% of the production as stipulated in the industrial licence. This, however, resulted in the domestic demand not being met, according to the company.

The professional equipments factory at Pune has now been fully geared for the design, development and production of complex electronic equipment and systems needed by the various users in the country and for the export markets. The main thrust of the activities in this field is in the direction of providing systems tailor-made to customers' applications. The plant management system developed by the company has been well received in the market.

The company spent Rs 20 million on research and development in 1977. About 450 persons are employed in its research and development laboratories.

In order to ensure continuity of the operations at the telecommunications factory at Calcutta the directors proposed to enter into a joint sector project with the West Bengal Electronics Industries Development Corporation (WBEIDC) for manufacture of trans-receivers. The company proposes to invest initially Rs 4 million (which is 40%) in the share capital of the proposed company. WBEIDC will hold the balance 60%.

A scheme for dilution of the shareholding of N.V. Philips' Gloeilampenfabrieken, Holland, has been submitted for the approval of the government of India under the Foreign Exchange Regulations Act.

BEL Encourages Sub-Contracting

Bharat Electronics Ltd (BEL) believes that sub-contracting components and sub-assemblies to ancillary units and small-scale industries is the best method of increasing value added per man hour.

It started its ancillary unit in 1965 with the establishement of 11 small units having combined production capacity of Rs 120,000 per annum. Now their number has risen to 14 with turnover of more than Rs 4 million per annum.

Also, more than 200 small industrial units spread over the whole country are now supplying BEL with sub-contracted items ranging from pins to professional-grade assemblies. The major sub-contracted orders consist of castings, forgings, plastic mouldings, rubber mouldings, machining, precision sheet metal components, electro-mechanical components, electronics assembling and sub-assembling, metal finishing, industrial tailoring and industrial packaging.

Siemens: Uncertain Outlook

The company's chairman, Mr D.M. Khatau, told the shareholders at the 21st annual general meeting of the company, held on March 1, 1978, that the company's operations had been adversely affected due to the disturbed labour situation at the Kalwa Factory, caused by inter-union rivalry. He cautioned that the outlook for the future was uncertain in view of the labour situation and the general economic outlook in the country. The chairman also pointed out that the impact of the union budget on company's operations would push the cost of production still further.

During 1976/77, the sales turnover was Rs 761 million (Rs 733 million): increase of 4 per cent. The pre-tax profits improved to Rs 86.6 million (Rs 80.3 million). The gross profit, however, showed a marginal decline to Rs 43.8 million from Rs 44.3 million, on account of the effective rate of taxation being higher.

The company's financial ratios have been quite good. The debt/equity radtio touched an all - time low of 0.3:1. The interest burden has been reduced to Rs 6.2 million (Rs 11.4 million) on account of improved working capital management. The company issued fully paid-up bonus shares in August 1977 in the ratio of one share for every two shares held. These bonus shares qualify for the full proposed dividends for the financial year 1976/77.

The company has maintained dividend at 16 per cent on the enlarged capital after bonus issue The dividend payment will involve Rs 11.5 million.

Khandelwal Herrmann — Siemens AG Collaboration

Khandelwal Herrmann Electronics Limited, presently engagged in the manufacture of electronic components and semiconductors, has entered into a collaboration with the Siemens AG for the manufacture of silicon controlled rectifiers and triacs. This agreement has now been approved by the project approval board of the government of India, according to the company

The initial investment in this project will be approximately Rs 10 million. The productionisation of SCRs and triacs is expected to start in a year and a half.

The special feature of the devices produced will be that they will be made in plastic housings and consequently will be available cheaper for use in household gadgets, motor controls, fan regulators and a host of other small motor control systems.

Names in the News

P.K. Sandell

Prabir Kumar Sandell, manager - communications division of Forbes Forbes Campbell & Co Ltd, Bombay, has now been appointed managing director of Uptron - Forbes Ltd. This company has been formed jointly by U.P. Electronics Corporation and Forbes Forbes Campbell & Co.

Mr Sandell carries with him a rich and varied experience of over 20 years in the field of electronics. At present he is also director of Vibronics Pvt Ltd, Sapte's Scales Mfg Co (Pvt) Ltd and R.S. Calculators Pvt Ltd. Between 1957 and 1973, he held various responsible positions in Philips India Ltd. He has also worked abroad in the Philips international organisation and other associated companies in Holland, W. Germany, the UK, Italy and the USA.

Mr Sandell has also served as the chairman, western region, Instruments Manufacturers & Dealers' Association (1970-72), and as editor of the association's technical journal. At present, he is vice - president, Non - Destructive Testing Society of India and president of India chapter, Instrument Society of America.

R. Mohan Rajan

Mr R. Mohan Rajan, director, Universal Biochemicals, Madurai received the silver award "1978-Marketing Man of the Year" from the union minister for communications, Mr B. Brij Lal Verma, at the fifth National Marketing Convention held at New Delhi on January 31, 1978. This award was given in recognition of Mr Rajan's contribution to innovation, adaptation, including product improvement, quality control and after-sales service. Mr Rajan also received the prestigious "Udyog Patra" award in 1975. ☐

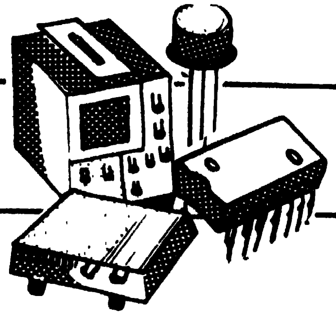
Complete Sets of EFY's 1977 Issues

A limited number of complete sets of the ELECTRONICS FOR YOU issues published during the year 1977, including Annual Number 1978, are available at their face value. Those who desire to have these issues may kindly get in touch with us at the earliest as the stocks are likely to exhaust very soon.

—Circulation Manager

PLEASE NOTE

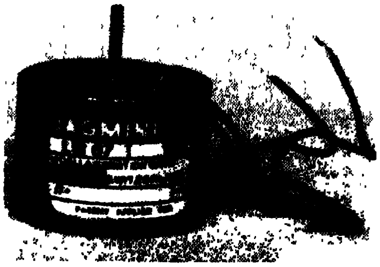
Annual Number 1978 includes the December 1977 issue. There was no separate issue for this month, as ever.



PRODUCT PROFILES

DC MICRO MOTORS

The 'Jagmini' permanent magnet DC micro motors now being produced by Jagran Micro Motors, Kanpur, promise low electrical noise, low current consumption, high efficiency and a steady speed. Being made in collaboration with Lenco Ltd, Switzerland, these motors find application in cassette tape recorders, record players and car stereo players etc.



When used with an external electronic governor, the motor works on a supply voltage of 4.2 V to 8 V, producing a nominal torque of 7 gm-cm and a nominal speed of 2000 rpm ± 1%, and consuming 85 mA current. Without the regulator it works on 3V to 10V, producing 8 gm-cm torque and consuming 95 mA nominal current.

Contact: Jagran Micro Motors Limited, C-9 Panki Industrial Area, Kanpur 208022.

NICKEL CADMIUM CELLS

Hermetically sealed button type nickel cadmium batteries are now manufactured by Techno Tronics Pvt Ltd, Bangalore and marketed under the 'Techtron' brand name. Their basic cell voltage is 1.2V; the stacks can be supplied in multiples of 1.2V up to 12V.

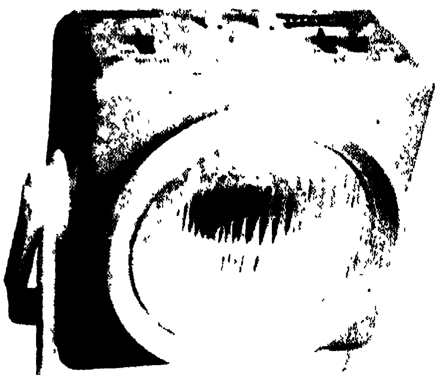
The button type cells are manufactured from 10mAh to 500mAh and have a life of more than 200 cycles of charge and discharge. These cells are available from stock or on short delivery.

Sealed cylindrical cells from 450mAh to 2.5Ah will be shortly available for sale. Chargers for all the capacities of the cells/ batteries are also being manufactured and can be supplied on specific order.

Contact: Techno Tronics Private Limited, A-1 Essae Industrial Estate, Bommanahalli, Bangalore 560029.

EMERGENCY LIGHT

'Telebeam' is a fully transistorised portable emergency light that needs no connection with mains, except for recharging its leak-proof and spill-proof battery. The battery charger with automatic regulation is built-in.



Incorporating photo - electric control and solidstate switching, it dispenses with relays etc and therefore avoids wear and tear of any parts. It has a built-in battery condition indicator and a unique flashing emergency becon.

Contact: Home Machines Private Ltd, 9/46 Kirti Nagar Industrial Area, New Delhi 110015.

ELECTRONIC TACHOMETER

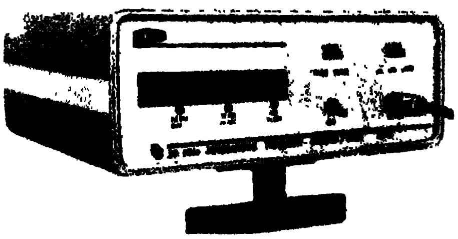
Excella now offers a non-contact electronic tachometer for measurements of RPM up to 50,000. The tachometer consists of a rugged magnetic pick-up, a solidstate electronic pulse shaper with regulated power supply, and an indicator of digital/ analogue type.

The salient features of this tachometer are: (i) due to vibrations or any environmental conditions pick-up does not fail, (ii) if the distance between pick-up and the rotating member changes then also there is no difference in indication unless and until it reaches the threshold point, and (iii) there is no wear and tear as it does not require any drive.

Contact: Excella Electronics, 54 Annapurna Indl Estate, Tilak Road, Ghatkopar, Bombay 400077.

AUTORANGING FREQUENCY COUNTER/ TIMER

Model 2010 is a 6-digit 20MHz frequency counter/ timer. With a sensitivity of 35mV RMS, it can measure frequency/ period from 1 Hz to 20 MHz. The gate time is automatically selected for maximum resolution. A manual attenuator is provided for measuring high amplitude signals.

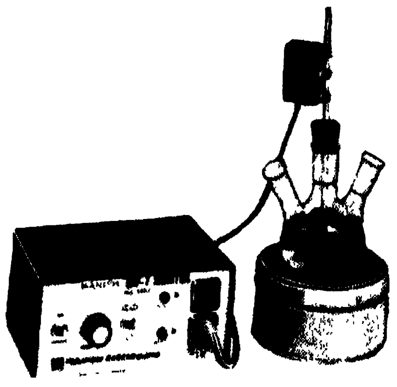


Contact: Punjab Digital Industrial Systems Ltd, C-30 Industrial Focal Point, Phase II, S.A.S Nagar (Mohali) 160051, Punjab.

SAF/T/MONITOR

This control device is designed to free the busy scientist from a variety of laboratory operations. It can control most operations in a system which result in a change of fluid level in a sight glass thermometer, manometer etc. Temperature, pressure, vacuum, liquid level, flow rate and many other parameters can be controlled by it. As a control device it can be used to cycle an equipment on and off as it reaches a pre-set control point. As a safety device the monitor can be used to shut off equipment and activate an alarm or other signal when the pre-set control point is reached.

The SAF T-Monitor consists of a solidstate control module and a sensing probe connected by coaxial cable. The probe clips on to the thermometer and manometer, and the clips sense the change in capacitance as the liquid level rises or falls activating the control module as required. The probe works equally well with either mercury or non-metallic materials such as water or alcohol.



Contact: Manish Electronics, 5 Karuna Bldg, Manava Mandir Road, Walkeshwar, Bombay 400006.

DIGITAL LOGIC PROBE

'Digi-Probe' gives the logic state indication in alphanumeric form which is unambiguous and cannot be misinterpreted.

The detection circuitry recognises three input conditions as defined by the TTL gate. It displays a 'O' for a logic zero input, a '1' display for logic one input, and 'F' display for the disallowed conditions of an open circuit or an input voltage between +0.8V and 2.4V (fault).

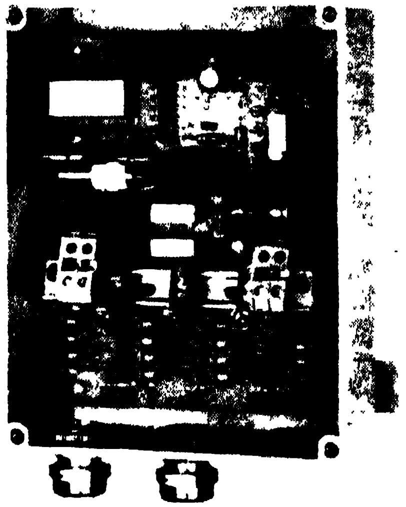
When a gate input is switching at high speed, it turns off the display and pulses the decimal point to indicate the presence of high frequency pulses. Even a single narrow pulse is stretched to 30ms and displayed.

The Digi-Probe does not load the circuit under test. In fact a current of less than 500 µA is drawn both in logic one and zero states, making measurement possible even with low-power TTL circuits. It can be powered by the 5V supply of the unit under test. The novel circuit design makes the power supply drain substantially constant, irrespective of LED display indicating a 0, 1 or F. This avoids the introduction of noise in Vcc line due to the probe.

Contact: Darbari Industries, 24 Mahatma Gandhi Marg, Allahabad 211001.

LIGHTNING PROTECTOR

Now available from Measurement Technology Ltd, Luton, England, the MTL 370 self-resetting lightning protection unit is a new two-channel safety device, which connects in series with post office or private signal lines to protect electronic equipment from high-voltage transients or prolonged overloads. No fuses blow when the unit does its work. Instead, a relay temporarily disconnects the lines and then resets, allowing the equipment to continue operating. Applications range from the protection of radio navigation beacons around airports against nearby lightning strikes, to safeguarding measuring instruments on transcontinental gas pipelines.

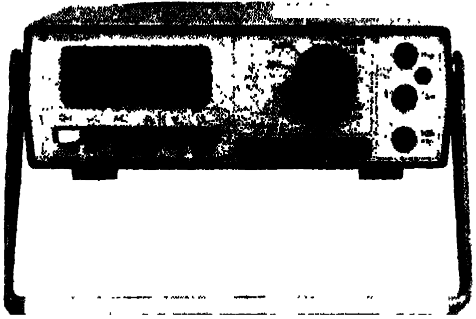


Special features of the new design include low channel resistance (37 ohms maximum) and the facility for users to adjust the working voltage in fifteen steps from 7V to 105V to suit different types of equipment. The MTL 370 requires no power supply, and is housed in a weatherproof polycarbonate enclosure.

Contact: Measurement Technology Ltd, Power Court, Luton, Beds LU1 3JJ, England.

LCD MULTIMETER

Gould Advance Ltd, England announces the DMM9, a new 4½-digit multimeter incorporating a 7-segment liquid-crystal display, a 0.05% measurement accuracy and root-mean-square measuring facilities. The DMM9 features 28 AC and DC voltage, current and resistance measurement ranges, including a separate 10A current range, and is also available with optional probes for temperature, radio-frequency and high-voltage measurements.



The DMM9 has a maximum reading of 19999, and maximum resolutions on the current, voltage and resistance ranges of 10uV, 10nA and 100m, respectively. The liquid-crystal display incorporates separate positive or negative polarity indication plus a decimal point. Overrange is indicated by a flashing display, while 'battery-low' indication is provided by blanking the least significant digit.

Options available include a temperature probe with a range of -20°C to + 120°C, an RF probe and detector, a high-voltage probe for measurements up to 40kV, and a printer interface offering a parallel BCD output.

The DMM9, which measures 227mm x 72mm x 260mm and weighs 1.9 kg, may be operated from 90-130V or 180-260V AC supplies (45-400Hz), or from four rechargeable 'C' cells.

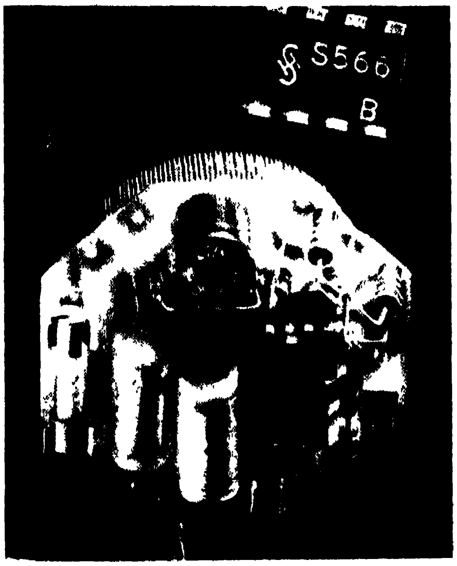
Contact: C.H. Krishnan & Associates, C-24 New Delhi South Extension (Part II), New Delhi 110049.

SENSOR CONTROL

The rotary potentiometer used in conventional electronic dimmer switches can now be replaced by a Siemens MOS IC. By touching a sensor surface it is possible to vary the brightness of light bulbs and also to switch them on and off.

A P-MOS depletion - type IC, S 566 B, has been used to design a dimmer switch without mechanical parts. There is plenty of room for the circuitry in conventional switch boxes, and there is no need for wiring modifications.

To switch a lamp on or off the sensor must be touched briefly for about 60 ms to 400 ms. When a lamp is switched on, the last selected brightness level is restored. To make the lamp brighter or dimmer, the sensor must be touched for longer than 400 ms without interruption. If this is repeated, the direction of brightness control is reversed. The time taken to go through the entire brightness range, e.g. dark - bright - dark, is about 7 seconds.



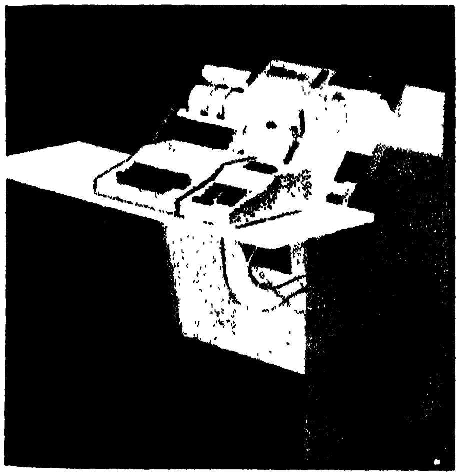
Any number of mechanical switches or sensors (consisting of a transistor and three resistors) can be connected to a special input of the 8-point MOS IC, which is mounted in a dual in-line package.

Contact: Siemens AG, Zentralstelle fur Information, Postfach 103, D-8000 Munchen 1, Federal Republic of Germany.

CARD PUNCH

The daro 415 card punch is an efficient instrument for punching numerical data into 80-digit cards. It can be used in any punched card - oriented kind of mechanical data processing. It comprises the following functional elements:

1. Card feeding magazine with 500-card capacity.
2. Card ejecting magazine, also with 500-card capacity.
3. Punching and sensing stations so arranged on the card way that the fed card passes first the punching station and then the sensing station.
4. Programming Unit located atop the card way with functions such as: (i) card skip over fields not to be punched, (ii) duplicating of data from advance cards or follow cards, (iii) idle step coding, (iv) punched field limitation, and (v) changeover from numerical to alphanumerical punching while using the combined keyboard.
5. The card punch may also be equipped with a constants device in addition to the programming unit.
6. It can also be equipped with a numerical or a combined numerical and alphanumerical keyboard.
7. Punching device which marks what punched cards were processed by what machine.
8. An easy - to - clear 6 - digit counter which records the number of punched cards fed in.
9. A column indicator which indicates which column of the punched card is in working position at the punching or sensing stations.



Contact: Robotron Export-Import, Volkseigener Aussenhandelsbetrieb, DDR 108 Berlin, Friendrichstrasse 61, German Democratic Republic.

FACTS & FIGURES

FOREIGN COLLABORATIONS

(Approved between April 1977 and September 1977)

Approved during	*Name & address of the Indian firm*	*Name & address of the foreign firm*	*Items of manufacture*
• April-June 1977	Premier Mills (CBE) Ltd, Electronics Units, Unit No. 3, SEEPZ, Andheri East, Bombay. (EPZ Case)	Schaefer, Mess technik GmbH & Co, KG, D-7401, Kustard-ingen/ Tubingen, FRG.	(Db) VU meters.
April-June 1977	Hind Rectifiers Ltd, Lake Road, Bandhup, Bombay	Westinghouse Brake & Signal Co Ltd, 3 John Street, London, WCIN 2ES, UK.	Thyristors
April-June 1977	Jesons Electronics Ltd, 73, Sundar Nagar, New Delhi.	Chemical & Carbon Products Ltd, Eveready House, 1255 High Road, Westone, London.	Dry cell batteries
April-June 1977(F)	Tata Sons Ltd, Bombay House, Sir Homi Modi Street, Bombay. (Composite Case).	Burroughs Corporation, USA.	Computer peripherals etc
• April-June 1977	S.K. Rungta A-12, Gulmohar Park, New Delhi.	Electronic Application Co Inc, 4918 Santa Avenue, El Monte, California 91734, USA.	Reed relays (electronic components)
July-Sept. 1977	Munshaw Engineering Industries Pvt Ltd, Kermani Building, Sir P.M. Road, Fort, Bombay.	Siegfried Peyer Ltd, CH-8832 Wollerau, Switzerland.	Electronic yarn clearer, type 'B'
July-Sept. 1977	Nivo Controls, 20/3 New Palasia, Indore.	G.H. Endress & Co, Switzerland	Electronic level controllers
July-Sept. 1977	V.S. Rajan, 501, Janambhoomi Chambers, W.H. Marg, Bombay.	Denver Instrument Co, 2050 South Pecos Street, Denver, Colorado, USA	Single/dual pan electro-mechanical, mechanical & electronic balances
July-Sept 1977(F)	Ruttonsha-International Rectifier Pvt Ltd, Post Box No. 661, G.P.O, Bombay.	International Rectifier, USA.	Silicon diodes & silicon pellets

(F) indicates cases involving financial participation also
• indicates cases with export orientation.

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4 Computers and calculators	320	280	1130	900
5. Controlled industrial electronics	350	300	700	630
6 Components	1830	920	2550	1800
7 Materials	380	220	350	700
8 Elementary and two-way communication	115	85	120	110

Source: Draft Five-Year Plan (1978-83)

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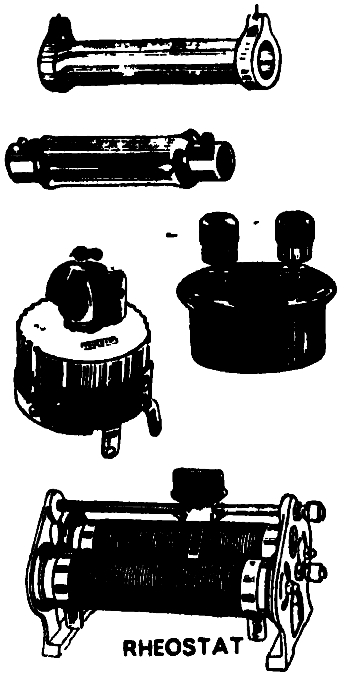

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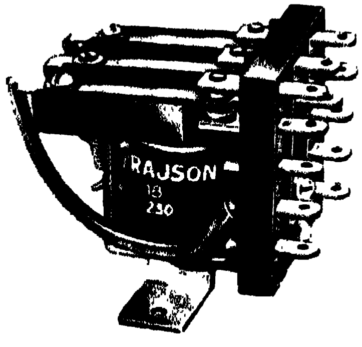

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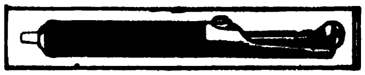

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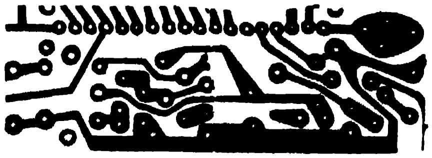

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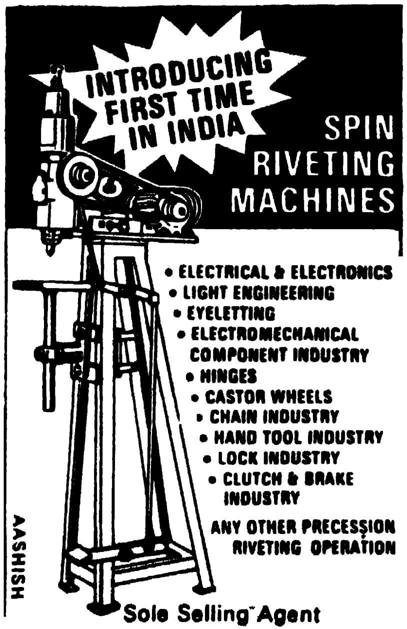
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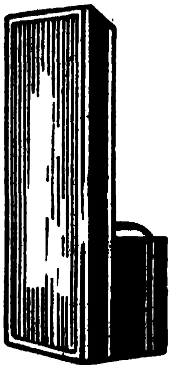

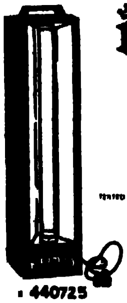

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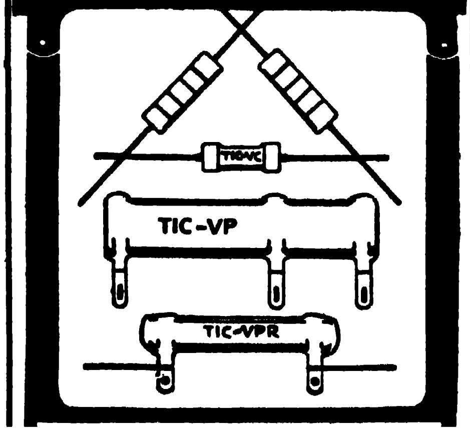

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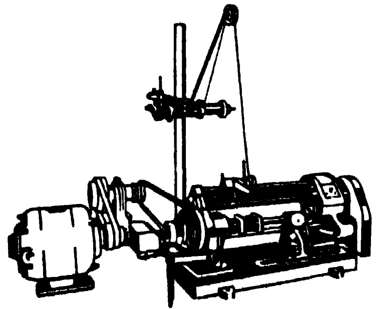

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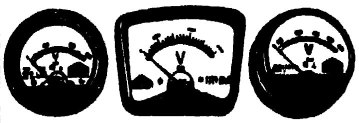

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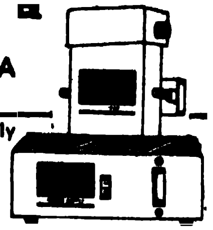

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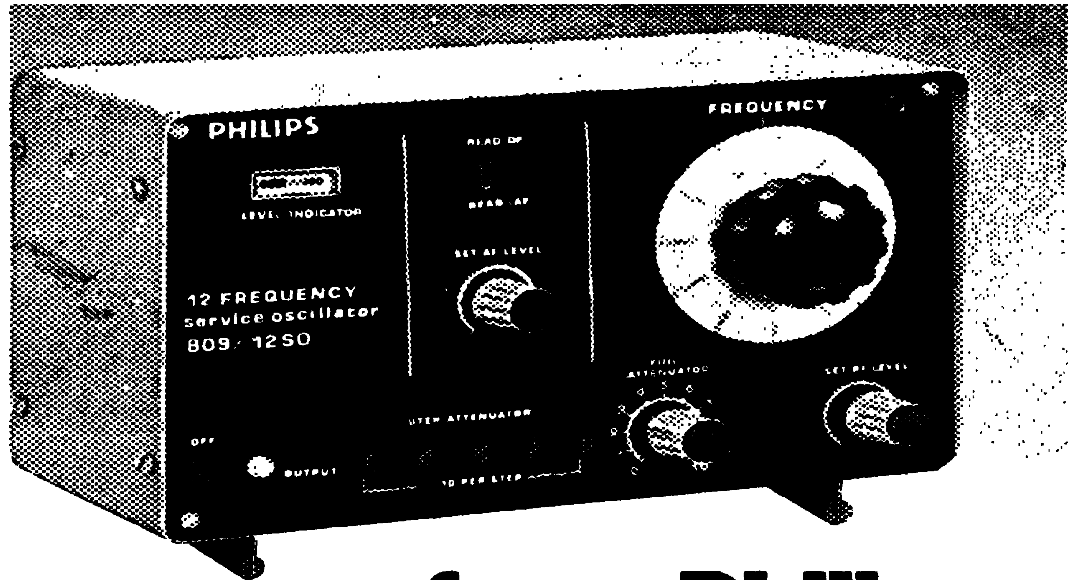

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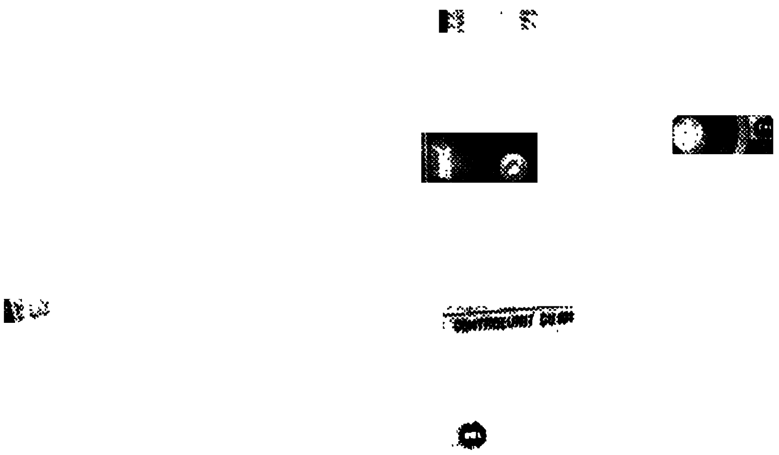

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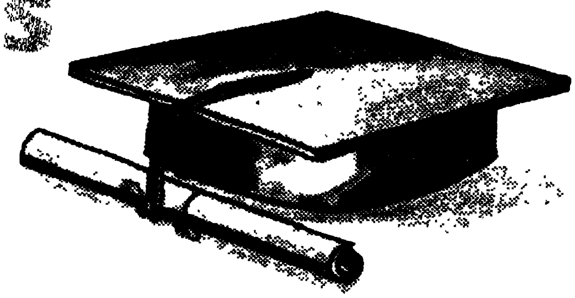

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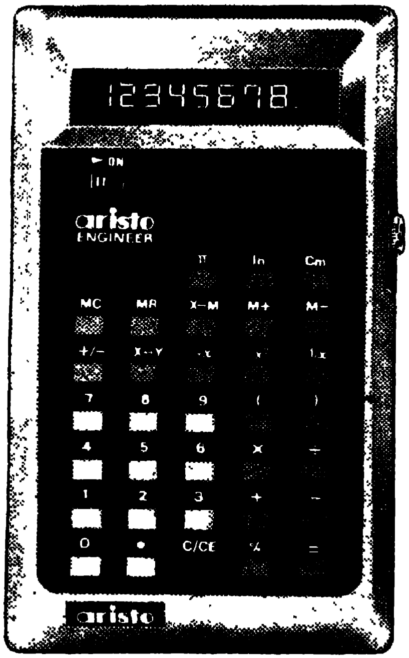

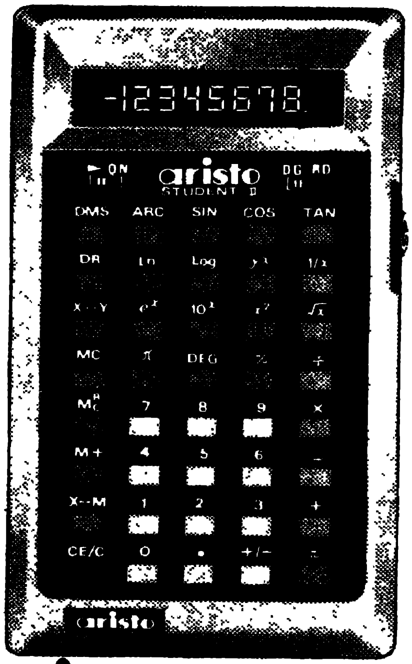

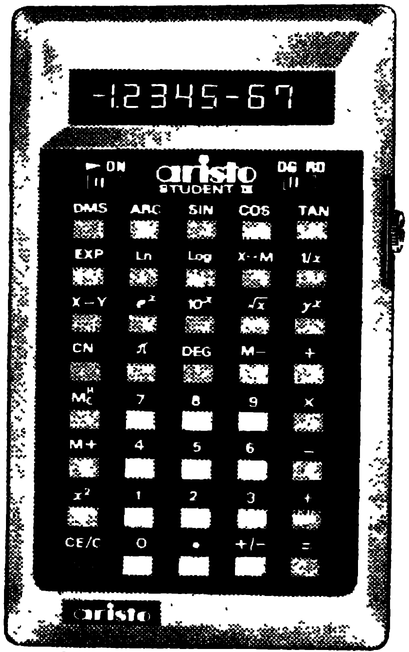

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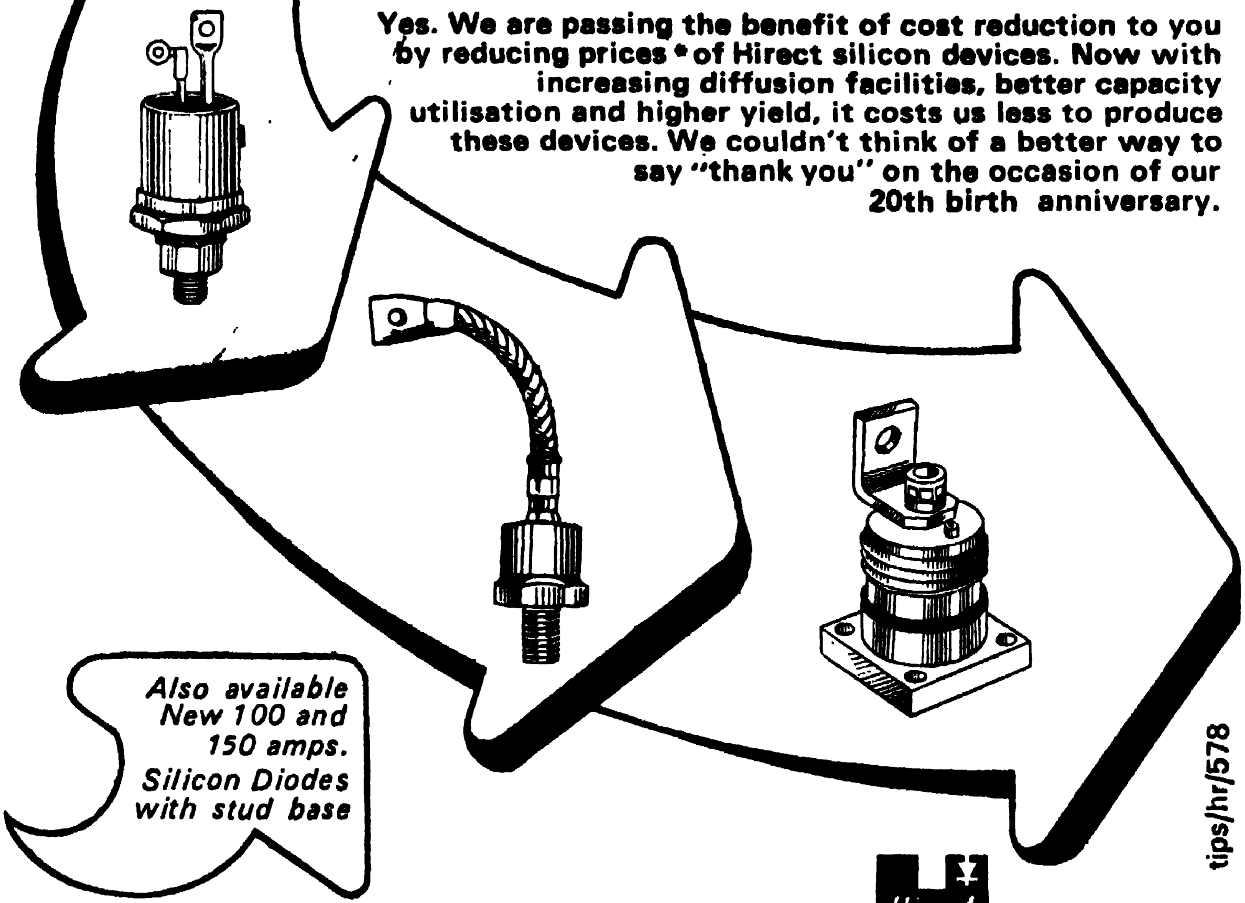

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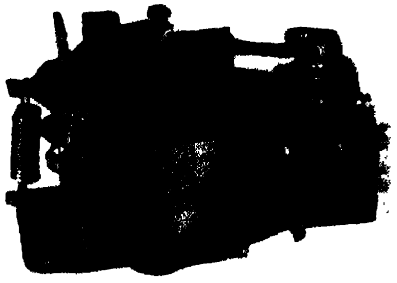
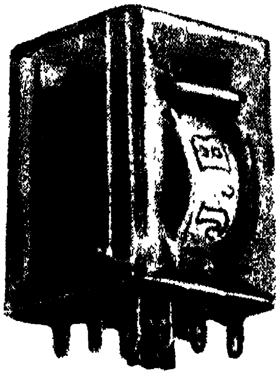
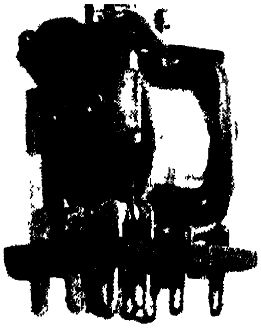
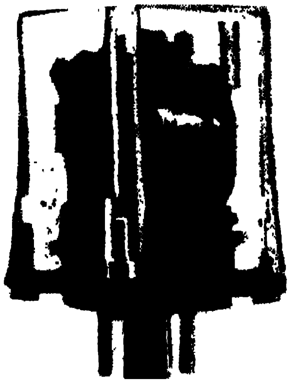

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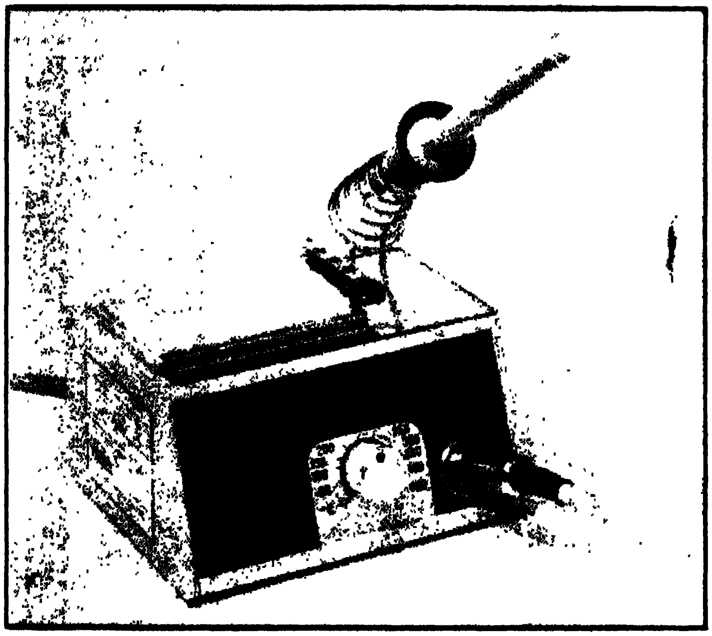

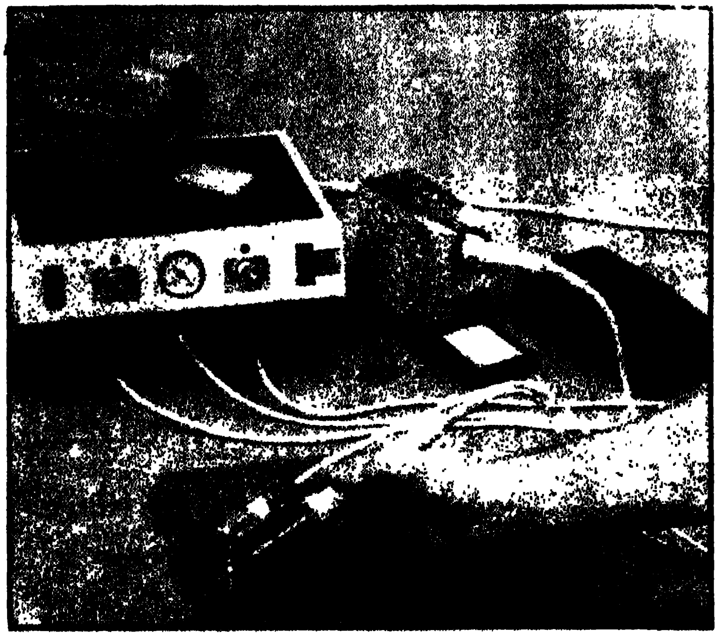

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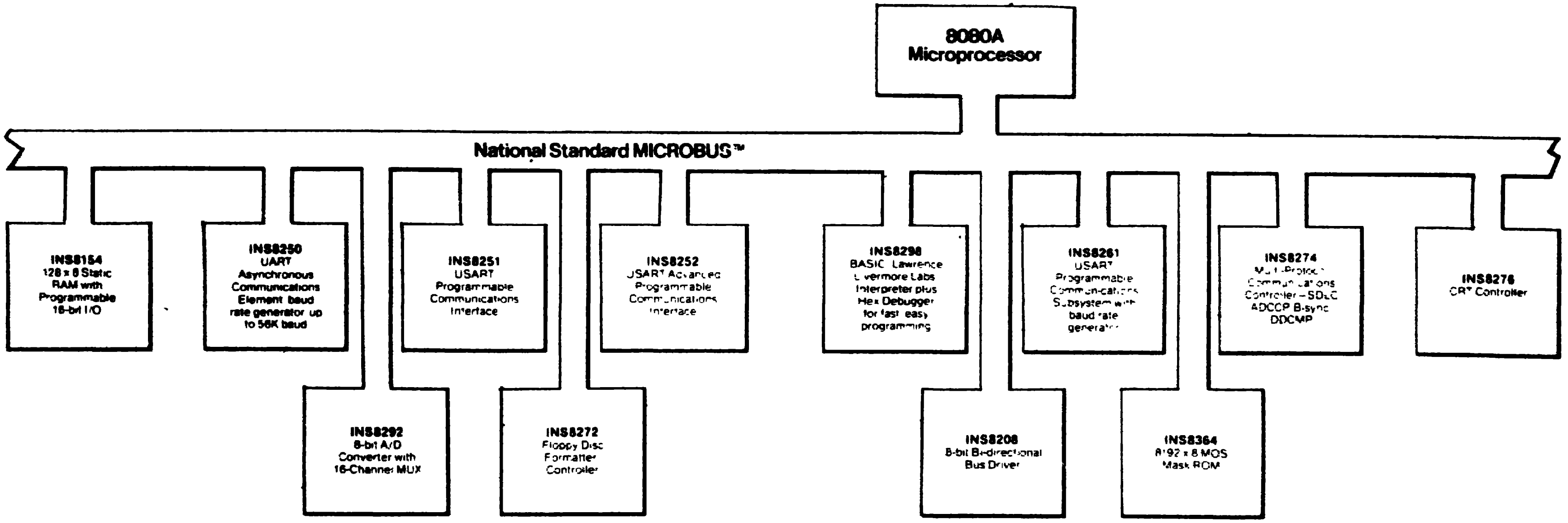
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2. Making of Remote Control Transmitter & Receivers
3. Criteria of a Professional Tape Recorder
4. Investing in Electronic Instruments & Medical Electronics
5. 555 Timer & Its Applications

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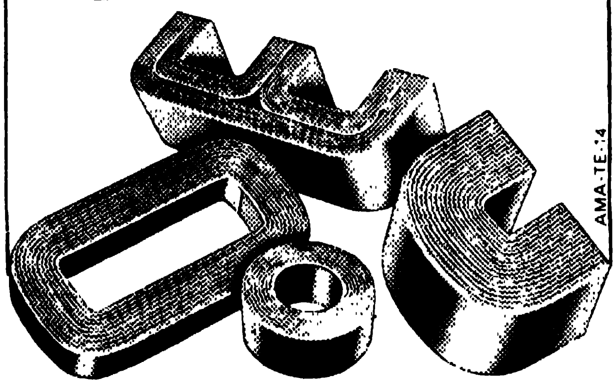

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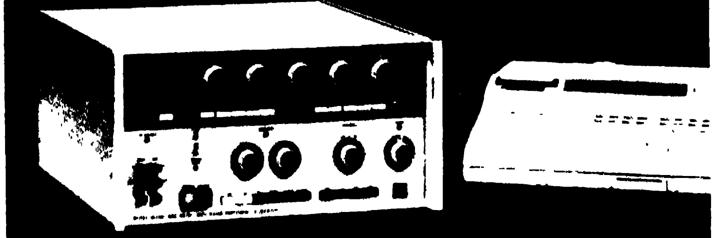

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EDITORIAL

SETTING THE STAGE FOR GROWTH

The annual report of the Department of Electronics for 1977-78 makes an interesting reading in more ways than one.

First, it shows that the electronics industry in this country is alive and kicking — this is evident from the fact that total production in 1977 at Rs 5085 million was significantly above the target of Rs 4540 million indicated in the Perspective Report on Electronics in India which was published in 1975 and which is deemed to be the Bible for this industry till 1985.

Second, the industry has registered all-round progress and not in consumer electronics alone. It is true that the rise in the production of radio sets, television sets, stereos, tape and cassette recorders, calculators etc is something with which the average citizen of this country is familiar, but the advances made in communication equipment, aerospace and defence equipment, computers and control equipment is of no mean order, even though they have not received adequate publicity.

Third, great emphasis has been laid by the Department of Electronics on the role of the small-scale sector in the development of the electronics industry. As a part of the new industrial policy of the government, the manufacture of 15 electronic items has been reserved exclusively for the small-scale sector.

Fourth, an attempt has been made to disperse this industry all over the country; a decade earlier it was concentrated in a couple of centres.

Fifth, great strides have been taken in the export of electronic products, and not of consumer electronics only which in 1977 constituted less than one-fourth of the total exports.

In addition to the above, there was significant rise in the production of record players, amplifiers, PA systems and mass communication equipment.

And all this progress was sustained by the units manufacturing components and materials. Here, the indigenous suppliers find it difficult to satisfy the domestic units. Says the report: "A serious shortage of certain types of components, particularly receiving valves, carbon-film resistors, electrolytic capacitors, ceramic capacitors, plastic-film capacitors etc was felt in 1977. A large number of TV units have represented about the very long delivery schedules quoted by prominent component manufacturers." The report has also complained that the quality of most of the indigenously produced components, even for consumer grade applications, is far from satisfactory. Surely, there is need for improvement in the working of some of the manufacturers of components.

All in all, the electronics industry can look forward to a rather comfortable future till the end of the current decade and even beyond. The size of the electronics industry in relation to the total population as well as the gross national product of our country is still extremely small. Whatever the level of living, the onslaught of the electronic gadgets and facilities is such as no one can escape. That thought alone brightens up the picture of future role that this industry is expected to play in our country.

Excerpts from the report have been presented elsewhere in this issue which set out a balanced picture of the progress of the industry. However, the progress made by the entertainment electronics industry in particular is at once fascinating and instructive.

Take the case of the television industry. The production of TV sets rose to an all-time peak at 238,833 sets in 1977 as against 143,777 sets in 1976. Two factors boosted the growth of TV industry, namely, the introduction of the economy models which enjoyed concessional excise duty, and the establishment of TV centres at such places as Jaipur, Raipur, Mussoorie, Gulbarga and Hyderabad.

The expansion in the TV industry in no way influenced the growth of the radio industry. This is evident from the fact that the output of radio receivers in 1977 attained an all-time high at 3.76 million sets. What is still more interesting is that the production of small-scale units was, for the first time in the history of this industry, more than that of the large-scale sector.

The tape recorder industry registered a growth of 60 per cent in 1977 over 1976. Whereas the production of tape recorders in 1976 was 68,718 sets only, it was as high as 111,789 sets in 1977. With rising production, prices have been declining, thus widening the size of the market.

Another sector of the electronics industry which made some progress in 1977 was that of electronic calculators. Here total production rose by 12 per cent to 75,623 sets but the fact which needs to be noted is that nearly 60 per. cent of these sets were produced by the small-scale sector.

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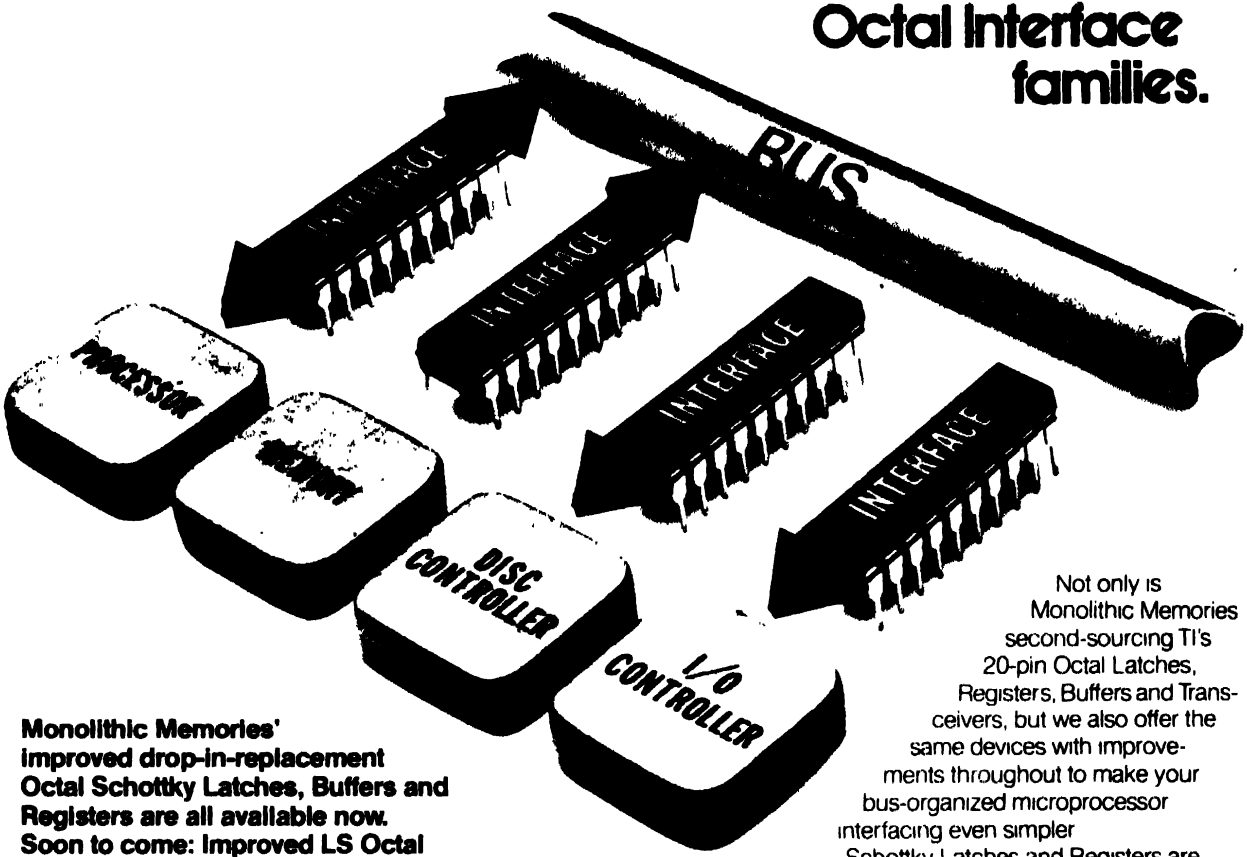

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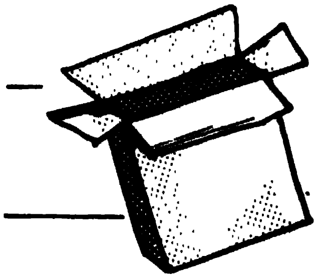


WHAT'S NEW

In India ...

Prior Approval Not Required for Making 20 Electronic Items

It is no longer necessary to seek a prior approval of the Development Commissioner, Small Scale Industries and the Department of Electronics (the controlling and policy-planning agencies on all-India level) for the manufacture of 20 electronic items listed below:

	Items	*Capacity (nos. per annum)*
1.	Tape recorder/Telephone answering machines/Dictaphones, Car cassette players and combination thereof with radio	5,000
2.	Cassettes/Pre-recorded cassettes	100,000
3.	AM/FM radio	10,000
4.	Mono/P.A. amplifiers	2,000
5.	Car radios	20,000
6.	Microphones	
	(a) For PA system	2,000
	(b) For Tape recorders	30,000
7.	Loudspeakers	100,000
8.	RF/IFTs & Tuning coils	500,000
9.	TV booster amplifiers	5,000
10.	Hearing aids	5,000
11.	Electronic flash guns	2,000
12.	Wirewound resistors	100,000
13.	Record players/ Changers	5,000
14.	Telescopic aerials for transistors & TV receivers	100,000
15.	Fan regulators	30,000
16.	Light dimmers	10,000
17.	Electronic gas lighters/ cigarette lighters	50,000
18.	Electronic emergency lamps	10,000
19.	DC power supplies, both regulated and otherwise	1,000
20.	Battery eliminators	1,000

These items have ceased to be sensitive from import content and technology angles. Also, these items are now either already reserved for exclusive manufacture in the small-scale sector or are being encouraged for manufacture in the small-scale sector.

For imported components required for their manufacture, import licence will have to be obtained through the concerned state's director of industries. A technical committee comprising of the representatives of the director, SISI and the state director of industries would look into the applications to keep a check on the state level. However, the raw materials and capital goods import applications would continue to be dealt with by the DC(SSI).

Electronic Items Banned for Collaboration Announced

The government of India has drawn up a list of industries including electronic components and equipment where foreign collaboration will not 'normally' be permitted. The list, however, does not concern the existing foreign tie-ups.

Two clarifications have been given by the Department of Electronics. First, even amongst the items contained in the list there is scope for flexibility in special cases. Second, those items left out from the list are not automatically open for foreign tie-ups. Decisions in their case will be taken according to individual circumstances.

The electronic components and equipment included in the list are: general-purpose transistors and diodes, wirewound resistors and potentiometers (other than professional), paper and mica capacitors, consumer grade variable capacitors and trimmers, loudspeakers, ferrites (excluding pot cores), TV deflection components, transformers, chokes and coils, radio receivers, TV receivers, tape recorders, record players, changers, PA systems, electronic kits/toys, oscilloscopes 50MHz and below, digital multimeters, digital voltmeters, audio and low-frequency oscillators and signal generators, video pulse distribution amplifiers, wobbuloscope, TV pattern generator, teleprinters, console typewriter, X-Y plotter, CRT display, ultrasonic & eddy current flaw detectors, annunciators, powerline carrier communication equipment.

Large Import of TV Picture Tubes

In his reply to a question posed in the Lok Sabha, the Prime Minister informed the House that 136,296 TV picture tubes were imported during 1977-78. As regards indigenous production, he pointed out that TV picture tubes are already being manufactured by Bharat Electronics Ltd and Teletube Private Limited. In addition, industrial licences for manufacture have been issued to West Bengal Electronics Industrial Development Corporation, Uptron Anand Limited and Asian Electronics. Besides, a letter of intent has been issued to Punjab Industrial Development Corporation.

Task Force for Exports of Electronic Goods

At the first meeting of the Central Advisory Council on Trade held at Vigyan Bhavan, New Delhi, on May 15, 1978, Mr Mohan Dharia, Union Minister of Commerce, Civil Supplies & Cooperation said that to intensify the export drive he was appointing high-powered task forces for major products, including electronics. During the next three months, this task force would draw up programmes for specific actions for (i) securing higher exportable surpluses through better capacity utilisation, new investment and modernisation, (ii) exploring new markets for our products, (iii) identifying new products for export, particularly where we have a comparative advantage, and (iv) improving export infrastructure.

So far, the composition of the task force for electronics has not been announced. EFY will be watching the deliberations of the task force with great interest.

Conference and Short Course on Digital Systems

An Indo-British conference on applications of digital systems is being organised by the Centre for Applied Research in Electronics and Electrical Engineering Department, IIT Delhi, in association with Prof. J.W.R. Griffiths and eight other experts from the UK who will deliver keynote addresses for various sessions of the conference. The conference is being held from the 12th to the 15th of September, 1978. It is open to all interested in applications of digital systems. The subjects for discussion include: processors and distributed computing, digital test instruments, digital communication equipment and systems, digital control systems (including sequential and feedback systems), adaptive digital systems, intelligent sensors for digital systems, modern programmable hardware, and software development systems.

The Indo-British short course on applications of digital systems being organised by the same institution is open to students, teachers and research workers in the area of applications of digital systems. Only those with an acquaintance of digital electronics and systems at Bachelor's level may join the course. The course starts on the 4th of September and ends on the 8th of September, 1978. Eight UK experts will be among the faculty for the course.

And Abroad ...

Cable TV Being Tried in Germany

Three West German cities—Munich, Ludwigsburg and Berlin—are now going to try out pilot cable television schemes.

If and when these schemes attain success and popularity, a social revolution will be inevitable. This is so because most chores which require stepping out of homes can be performed by cable television. Paying bills, going to the doctor, work, leisure, further education, contacts with friends and neighbours, participation in political events and more can be done via a home TV.

The range of cable TV is far greater than wireless radio and TV. More significant is the fact that the TV viewer can make contact with the central TV studios and with other TV viewers via cable TV.

All these innovations could be turned into a reality within the next generation. There are, however, two major snags which must first be resolved. First such schemes involve a high cost. The cost of the 3-year trial in munich is estimated at DM 200 million. The costs of a nationwide cable network alone in Germany are estimated at DM 25,000 million. The second snag involves the social impact of such schemes. The important question is—do men and women find the prospect of sitting at home all day watching cable TV inviting? The answer to this question will determine the extent of success cable TV schemes are destined to attain.

Growing U.S. Markets for Electro-medical Equipment

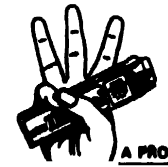
Sales of biomedical electronic patient care systems to the U.S. markets are projected to increase 11 per cent annually through 1990. It is predicted that by 1990 $ 7.2 billion worth of such equipment will be demanded annually in U.S. markets. This rapid rise in the size of the markets for these labour saving devices is a result of the health manpower shortage and the need to increase medical productivity. The trend towards increased hospital services and facilities is an additional factor contributing to increasing demand. Very important, however, is the image factor—computerised medical equipment is visual proof of a hospital's advanced care capabilities and greatly enhances its prestige.

Space Shuttle Radio System

RCA has been awarded a NASA contract of approximately $8.6 million to produce a radio system for communications amoung Space Shuttle crew members during space walks and for voice contact between the returning spacecraft and ground stations.

Two types of RCA radios will comprise the EVA/ATC (Extra-Vehicular Activity/Air Traffic Control) communications system. One will be included in astronaut backpacks for communications between space walkers and the orbiting Shuttle. The other, to be installed in the spacecraft, will link the Shuttle with EVA crew members. Later, as the shuttle re-enters the earth's atmosphere, this radio will provide communications with "chase" airplanes and air traffic control stations.

The Space Shuttle is the first re-usable spacecraft and its initial orbital test mission is scheduled for next year. It will be used throughout the 1980s to insert satellites into orbit and later, to service and even retrieve them from space. Launched as a rocket, the Shuttle Orbiter will be piloted back to earth as a powerless aircraft. The Shuttle Orbiter will accommodate a three-man crew and payloads of up to 65,000 pounds.



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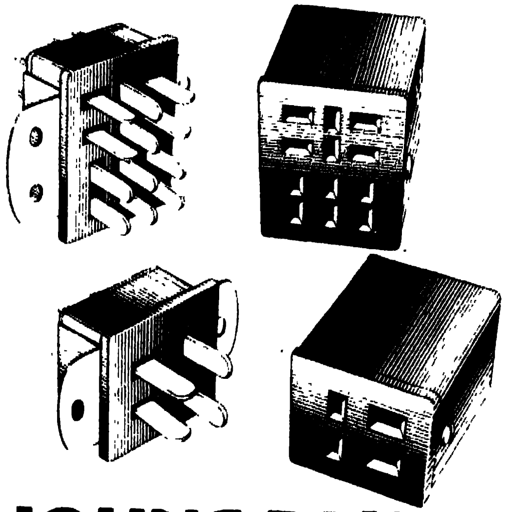

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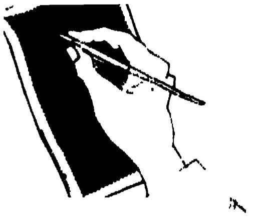

LETTERS

DIGITAL INSTRUMENTS SUPPLEMENT

It is always interesting to go through your exclusive journal on electronics every month. But your April issue was not - so - very - interesting, particularly the Special Supplement.

It is not because our company's name has not been included as a manufacturer of Digital Frequency Counters and Digital Multimeters, but because the lists mentioned do not seem to be realistic.

Names of certain new units who are only known to have received industrial licences, but have not started production yet, were included. Your remark "Manufacturers of some popular digital electronic instruments" is therefore misleading. But as a first attempt, I must congratulate you on preparing such an exhaustive list of so many products.

JAWAHAR KAPPAL
Ruttonsha Simpson Pvt Ltd
New Delhi

■ We manufacture Digital pH Meter, Chloride Meter, and a Digital attachment to Model DD-450 Flame-photometer.

Sales Division
Elico Pvt Ltd Hyderabad

■ We were glad to see our name in 'Digital Instruments Buyers' Guide', but we are sorry to tell you that our name was omitted in the addresses column.

ASHOK ELECTRONICS
11 Tinwala Building, Tribhuvan Road
Bombay 400004

■ Kudos to you for publishing such nice articles about developments in the fields of electronics and communications.

The special supplement on digital instruments was worth reading and thought provoking. But there was a lapse in the article on logic clip. According to the author, the logic probe is used in series with a diode (D5) to avoid damage to the probe due to wrong connections.

Since an ordinary conducting diode itself consumes some voltage, the voltage at both ends cannot be 5 volts when the diode is conducting. In fact, it will be less by 0.3 volts at one end in case of a germanium diode and by 0.7 volts in case of a silicon diode. We are not at liberty to allow this much degradation in supply voltage in TTL logic (which the author is using in logic clip) because of the ambiguity between 0.8 to 2 volts to select the on or off stages.

In a seven-segment LED, each LED will require a minimum of 3 volts to glow, which can't be supplied if a diode is connected in the probe itself. So, the diode D5 should not be used.

MOOL RAJ
Roorkee

Mr Kataria clarifies:

The diode D5 used in series with the supply to the logic probe is a germanium diode which will drop about 0.3V, resulting in an effective supply voltage of 4.7V. This is well above the minimum voltage of 4.5V at which the TTL ICs function well.

The LED display used is of the gallium arsenide type. So the forward voltage drop for any segment, when it is glowing, is 1.7V and not 3V.

Regarding the necessity of the diode D5, it must be used to avoid damaging the ICs used in the logic probe. Reverse polarity can cause a large amount of current flow into the IC chips and can thus cause a damage. Besides, such a mistake can damage even the power supply of the equipment if adequate overload and short - circuit protection circuits have not been used.

■ A detailed explaination of the circuit comprising C2, R6, D2 and IC2 in the "Direct Reading Logic Probe" article (EFY, April'78) by Mr G.L. Kataria is desired. I would also like to know the pin number for the decimal point and the approximate cost of making this pboject.

PRADEEP A. MASKERI
Bombay

Mr Kataria replies:

C1 and R7 differentiate the pulse fed from the probe tip. The falling edge of the differentiated pulse triggers IC2, which is a monostable IC whose time period is determined by R6 and C2. The values used give a time period of about half a second for which duration the Q output pin 1 changes state from the normal logic '1' to logic '0'. The Q output activates gates 3 and 4 and the relevent segments of the display to form the letter P. If a pulse train is present at the probe tip, the monostable IC gets retriggered after each half second and the probe displays P continously. Diode D4 has been used for protection of IC2 which is required wherever a large value is used as the timing condenser (C2).

Pin number for the decimal point (D.P.) is 4 and the common cathode terminals are 5 and 10. The total cost of the logic probe described is about Rs 85.

Here is Mr A.S. Sharma's rejoinder to Prof. S. Banerjee's letter published last month:

My article was meant to be controversial and my "partisanship" is based on sanity and common sense. Prof. Banerjee has not challenged my basic premises that "TV receiver industry is a mass production industry and small - scale production not only results in an unreliable but a costly product as well," and "Vertical integration, in addition to improvement in quality would mean better utilisation of facilities — production as well testing — and at least 15% reduction in production cost for a complete TV receiver."

The customer deserves a TV receiver which is low in cost, reliable in operation, easy to maintain with low cost of servicing. It matters little to him who

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produces it, how it is produced, and what circuitry it contains. As things stand in this country, only hybrid receivers can meet the above criteria.

I had talked not of large-scale sector and small-scale sector, but of large - scale production and small - scale production. Prof. Banerji is probably aware that today a unit producing the largest number of TV receivers — practically 20% of country's total production — has a total annual production of over Rs 100 million, but it is registered as a small - scale unit and gets all the benefits as such. Today it is the so - called large - scale sector which is being discriminated against.

I certainly want the units with large - scale TV production to be allowed or forced into vertical intergration so that a part of enormous profits are ploughed back into components development and production. Development of electronics industry in the country depends on healthy development of the components sector. This sector is being neglected because we know we can import the components any time we want. In case of TV receivers, imports of picture tubes, deflection components, ICs and high - voltage solidstate devices continues. Here again it is only in case of hybrid circuit which needs only an imported tube, if at all, that all components are available in the country.

I stand by my statement that "Hybrid sets use solidstate devices as well as vacuum tubes and make the best use of present state of art." Leaving out the copy - writers' jargon, picture quality or sound of hybrid receiver can be as good as of a solidstate set. It would be interesting to point out that like India, the American markets dependent on the high pressure salesmanship succumbed to assumed virtues of a solidstate receiver. On the other hand, Britishers accepted solidstate receivers only when they became competitive with hybrid receivers.

Not only Jyoti Electronics but serveral other assemblers are working on lowering down the cost of solidstate receivers, without diminishing their reliability. But as things stand, the price that a customer is expected to pay for solidstate set is too high, reliability is low and maintenance cost high. In case of failure of the high - voltage horizontal output transistor, which is quite common because of large mains fluctuations in our country, a customer may have to pay over Rs 200 for the replacement alone. Cost of maintenance of a hybrid receiver is very much lower.

To an Indian customer sets using exclusively solidstate devices or ICs do not offer any particular advantage. To change over to solidstate devices from vacuum tubes just for the change sake or in the name of high technology with no particular advantage to the user is not a correct design or engineering approach.

I wish Prof. Banerjee had commented on the use of Indian ICs. It has been unfortunate that assemblers have continued to base their designs on continental ICs which are different from those being produced or likely to be produced in India. With only a few hundred sets in the market using a particular imported IC, the customer will pay a high price in replacement. ICs being produced or likely to be produced in India are definitely not direct replacement of ICs being imported for use by assemblers presently.

Ofcourse it is taken as a gospel truth that "reliability of ICs is much more than that of equivalent discrete components." Unfortunately, the data reproduced in my article on the basis of information from ITT subsidiary indicated that 40% of failures are due to IC failures. Secondly, IC failures quite often take place because of associated component failures. No advantage will be obtained by the use of ICs, therefore, unless associated components with higher reliability are used. I would repeat my suggestion that assemblers using ICs should go in for functional modules. This would keep the cost of replacement and maintenance low. In case of non - availability of ICs, the complete module can be replaced — it may use discrete components or readily available ICs.

To the best of my information none of the units indicated by Prof. Banerjee e.g., Electronics and Computers, ECIL, Semiconductors Ltd and Hind Rectifiers are small - scale units. The few "low - power transistors" from BEL which are being used by Jyoti Electronics, are also available from some of the other firms named. But I am sure Jyoti Electronics finds the devices from BEL more reliable in operation and consistent in quality batch to batch. They could obtain these devices from any of the above units, but they do not! And why should BEL or Philips be expected to produce every device on earth?

I am unable to comment on the claims of Prof. Banerji regarding Jyoti Electronics or its product as I have no first hand knowledge. However, it appears that they decided to "produce Rolls Royce at high cost." Availibility of specialised components from various small units confirms my view of the role small units can play as ancilliaries specialising in production of quality components of specialised nature.

Prof. Banerjee would agree that any industrial policy must aim at production of goods for the user at a reasonable price. Electronics is a technology based industry. Unless rapid investment is made in the production of components, industry would have no future. Only verical integration can ensure a free flow of capital for the industry. Department of Electronics and Electronics Commission have failed to evolve a long - term policy for development of the industry. Electronics industry needs large - scale investment on a continuous basis. It cannot progress on the ad hocism practised by the Department of Electronics and Electronics Commission. And I am sure that wisdon is no departmental monopoly.

I wish Prof. Banerjee had provided some specific data regarding the relative components cost and cost of production, as well as relative reliability of TV receivers with hybrid circuitry, solidstate and IC circuitry. ☐

Spectacular Growth of Citizens Band Radio

G.V. Sulu VU2GV

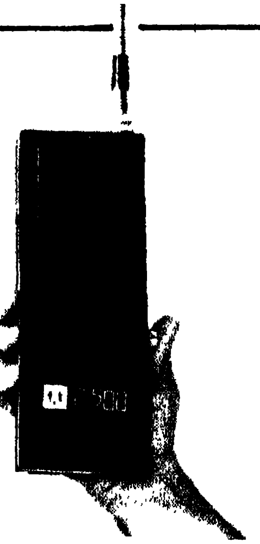
There is a spectacular growth in Citizens Band radio communication in the United States of America (USA). There are 14 million licencees using over 25 million transceivers now. The citizens band has also gathered momentum in several other countries. But so far it has not made much headway in India.

The rapid advances in science and technology have significantly changed our way of life, our social concepts, and also the social needs. The advent of the telephone and its phenomenal growth during the last 100 years resulted in the telecommunication facility becoming an essential part in our day-to-day life. The conveniences stemming from telecommunication services stimulated the rapid growth of complex social and industrial activities. These in turn led to ever-increasing demand for instant telecommunication service, both for individuals and organisations. So much so "do not commute, but communicate" is becoming an adage.

In the USA, telecommunication services are not the monopoly of the government or any private organisation. All types of telecommunication services offered by the latest advancement are pressed into service for the benefit of the citizens. First it was the amateur radio — a two-way radio communication by private experimenters. There are over 300,000 radio amateurs in the USA today. These amateurs are permitted to handle third party messages — passing messages of friends and others from one part of the country to the other and also to certain other countries, over amateur radio, free of charge. Amateurs use wireless telegraphy, radio telephony, radio teletype, and also visual communication such as slow-scan television. They are allowed to have what is known as 'Phone Patch', i.e. long-distance communication to certain foreign countries via the local telephone patched through amateur radio link.

Class 'A' service

Besides the telephone service, which is quite efficient, the need for some sort of mobile communication facility for the U.S. citizens was felt. The amateur radio that requires passing a test, etc is not suitable for the general public. Low-power two-way radio communication system without the requirement of any qualification or experience is more suitable. This led to the introduction of General Mobile Radio Service, Class 'A' in 1947. Under this system any citizen above 18 years of age can have radio communication equipment for personal communication within a city. The operation was permitted in one of the 16 spot frequencies alloted in ultra high frequency band (462 to 467 MHz) with the transmitter power up to 60 watts.



A portable CB transceiver developed by Central Electronics Engineering Research Institute, Pilani (*Photo:* Courtesy M/s Punjab Wireless Systems Ltd, Chandigarh).

Class 'B' & 'C' services

Within a year class 'B' service was introduced with lower power in 465 MHz band meant for small business and industrial operation. Since both these services were in the UHF band, their range of communication was very much limited. Also the UHF equipments were costly. Besides, tall concrete buildings in the cities obstructed the passage of UHF signals. Hence these services did not become popular.

The class 'B' service was suspended in 1971. Class 'A' service, however, continues with about 3,000 base stations and over 15,000 mobile stations in operation now.

In 1954, class 'C' service was introduced for radio and remote control operations.

Class 'D' service

In the USA it is believed that the radio frequency spectrum is a national resource like air and water, and in principle all members of the public should have access to it under properly-regulated conditions. They also feel that radio communication facility should be freely available to the ordinary citizens without much formality and restrictions. Both class 'A' and 'B' services did not adequately meet this requirement. This ultimately brought in Citizens Radio Service Class 'D', the popular Citizens Band (CB for short) in the 27 MHz band in 1958.

CB toys

In this new service, CB tranceivers with up to 100 milliwatts power (with which communication can be had up to a distance of say two kilometres in a city) are to be treated as toys for children to play with for which no licence is required. And for regular use CB sets with five watts power in 26.965 to 27.23 MHz band are available for any citizen who wants them. There is absolutely no restriction as to what purpose the sets are to be used. The sets were licensed for a five-year period with $ 20 as the licence fee. Up to five sets can be used with one licence.

Versatile CB

Within a short time the CB became a versatile medium for communication as it offers continuous communication facility to farmers, doctors, lawyers, teachers, taximen, housewives, office workers, executives, etc. In fact, it is a handy medium for people from all walks of life. The housewife can communicate with her husband whether he is in his office or on the highway. Husband on his way home can inform his time arrival or delay. Drivers in moving vehicles can get information on roads in a new area or the information on traffic density or bottleneck on their route. They can call for assistance in case of an emergency on the road, can locate the nearest petrol bunk, can make reservations in motels (or hotels) and cinemas, can check up parking space or camping ground, etc while on the move. Taxi stands and departmental stores can continuously keep in touch with their vehicles on the job for optimum deployment. In short, CB can be used to meet a variety of communication needs of the citizens and it has been assisting them in the conduct of their personal and business activities.

As the number of CB users multiplied, the 27MHz band was divided into 23 channels. The users voluntarily reserved some of these channels for certain specific purposes, such as Calling Channel, Emergency Channel, Commuter Channel, Local Traffic Channel, etc. For instance, channel 9 is REACT channel for emergency communication, channel 10 is for communication among the vehicles on the highway, channel 11 is for calling stations, and channel 13 is reserved for Maritime communication, etc.

G.V. Sulu

The turning point

Though there has been a steady growth since 1958, the real turning point for CB came in 1973. The energy crisis forced the U.S. government to economise on petrol consumption. Consequently, the maximum speed on the highways was restricted to 88.5 kms (55 miles) per hour. To check the violations, speed traps were set up on several places on the roads. The long-distance truck drivers found the traps rather irksome. Hence,to locate the speed traps and warn their fellow drivers, they started using CB sets. It was also used for locating shorter routes, avoiding traffic jams, and so on. Such voluntary road information service naturally induced millions of motorists to go in for CB sets.

The millions of CBers communicating daily have evolved a language of their own in the process. It is a mixture of American slang and hence is known as 'Slanguage'. They have their own codes for, government, police, speed traps, petrol bunks, service stations, etc. Apart from these they have also evolved what is known as 'CB-10 code'. *What is your 10-20?* means "What is your location?". A reply to this would be something like: *10-20 here is 15th mile on the 6th National Highway.*

Citizens band has brought in a significant change in the social behaviour of its users. The drivers on the roads, who are normally reserved, started communicating with their fellow drivers on the roads through CB, not only for assistance or guidance, but also for simple chit-chat to overcome the boredom of long drives. People with this communication facility become so sociable that they offered to pass on or relay messages of even strangers. In fact, they are often found vying with one another in trying to be helpful to even strangers. This naturally has had a profound effect on cultural and social life of the citizens.

The ever-increasing popularity of CB brought in further concessions from the authorities. In January 1977 the CB service was redesignated as 'Personal Radio Service' and the rules and regulations were further simplified and relaxed. Additional frequencies were also allotted (extended up to 27.405 MHz); so much so, the whole band is now divided into 40 channels — an addition of 11 channels. And when all the old equipments are replaced by new equipment that have provision for SSB mode of operation, the number of channels would be doubled. An increase in CB antenna height from 6.1 metres to 18.3 metres was also allowed (for omnidirectional antennae) which in effect increases the range of communication. The maximum distance over which a CBer can communicate has been extended to about 240 kms and he is now permitted to relay others' messages too over that distance.

The licence fee which was $ 20 has been brought down to a mere four dollars for a five-year period. Due to a court injunction, no licence fee for any of the radio services is being collected by the authorities since January 1977. So, the licences are issued virtually free of charge for the present. Further, instead of having to wait for a few weeks to get a CB licence before going on the air, now one can, as soon as the equipment is bought, issue one's own 'temporary permit', make up one's own call sign and go on the air, pending receipt of the formal licence from the authorities. The call sign, by the way, is formed with three letters followed by four figures, e.g., GVS-7388.

Since there is a likelihood of interference from the 100mW toy transmitters, a new frequency band is being allotted to them in 49 MHz, effective from 1983. Till then they are permitted to continue operation in the present 27MHz band.

To cope up with the future demand for CB frequencies, the U.S. authorities are considering another service, class 'E', in the 220 to 225 MHz band. At present this band is allotted to radio amateurs who have protested against this proposal. The American Radio Relay League, the foremost radio amateurs' organisation, after conducting several tests, suggested 908MHz band for the class 'E' service as an alternative. An official decision is yet to be taken on this.

Japan leads in the manufacture of CB equipment in the world. Even in the USA there are more Japanese sets in use. Still, for U.S. manufacturers, CB equipment is a billion dollar business. Early bulky tube versions have given place to compact solidstate versions since the mid-sixties. Sets made since 1972 had one of the 23 channels for AM cum SSB. The latest 40-channel equipments have provision for both AM and SSB operation. Originally, frequency stability was achieved through crystal operation — both in the receiver and the transmitter. Then came crystal synthesiser circuits. The phase-locked loop circuits are used in the latest equipments.

Some of the costly sets now available incorporate advanced techniques. They have microprocessors for automatic scanning of the channels and returning to the preassigned frequencies. They also have selective signalling system in which the tone-encoded squelch circuit can activate a transceiver to enable direct ringing of the required party; using low power, hand-held sets now communicate over longer distances; repeater stations on elevated locations have started coming up in all the cities. These community repeaters are installed and maintained by CB clubs. Through them, with a 2-watt set communication can easily be had over more than 60 kms distance in the cities.

Mexico and Canada, because of their proximity to the USA, have permitted CB operation with the same facilities as in the USA. This also helps equipment compatibility among these countries. In Canada they call it 'General Radio Service' and they had only about 300,000 CB licences till the end of 1976. Now they have nearly 700,000 licences. In Europe, they have CB in France, Germany, Sweden, Italy, Denmark, etc. In these countries the power is restricted to half a watt. Japan permits CB transmission with up to 5 watts power.

In Australia, the government resisted CB for a long time, even though a large number of U.S. type CB sets were in operation illegally. Finally, in July 1977, they decided to introduce CB in UHF bands. They have also decided to licence the existing (illegal) 27MHz sets. These sets can be operated up to 1982 after which CB will be in UHF bands only. The licence fee is A $ 25 per set, which is quite high.

In UK, the authorities are still undecided about introducing CB, though a considerable pressure is being exerted on it. The problem there is that there are a large number of radio paging and radio controlled equipments, besides the medical and industrial applicances, all operating in the 27 MHz band. If the U.S. type of CB is introduced, it would affect the services operating in the 27MHz band. So when UK decides to have CB, it would probably be in VHF or UHF bands.

In India

CB type of sets are being licensed in India since the last fifteen years. Yet we have only about 300 such licences so far. The reason for this apathy is not far to seek. The major impediments to CB here are:

1. Toy type CB sets require a licence here, though no royalty needs to be paid. But it can only be used for personal communication and absolutely no business communication is permitted.
2. High cost of these flea power sets and high licence fee compared to the common man's standard of living.
3. Royalty payable for sets above 100mW for personal communication and royalty for all business communication, irrespective of the power of the sets.

If the sets are made cheap and a nominal licence fee is charged for non-commercial operation, such radio communication is bound to become popular within a short time. Since the manufacturing of wireless sets is restricted to the public sector in our country, it should be possible to produce cheap sets due to the availability of cheap technical skills.

As things stand today, any Indian citizen above the age of 18 can get a CB licence without any test or examination by applying in the prescribed form which can be had from the Wireless Adviser, government of India, Wireless Planning & Coordination, Patel Bhavan, New Delhi 110001. The annual licence fee which was Rs 15 till recently, is now Rs 30 per set. Since a minimum of two sets are required for a link, the licence fee comes to Rs 60 a year.

CB in India is primarily meant for personal communication — for sports, recreation, etc. Hence the power to the built-in whip antenna is restricted to 100 milliwatts (300 milliwatts DC input to the transmitter). There is no royalty. Transmission and reception on behalf of a third party is, however, prohibited.

For transmitting power higher than 100mW for non-commercial purposes, and for commercial purposes even for power below 100mW, royalty has to be paid. The present rates of royalty are Rs 200 per annum for commercial operation up to 100 mW power, for communication range up to 3 kms. For communications beyond 3 kms (up to 80 kms) higher power is permitted with royalty going to Rs 1200 per annum for 24 hours and 365 days' operation. The royalty is reduced proportionately if the number of hours per day and the number of days operation in a year are reduced.

The CB operation is permitted in one of the five spot frequencies available in the 27MHz band, i.e. 26.968, 26.976, 27.035, 27.065 and 27.125 MHz. The frequency assigned is on non-interference basis to other services, and the department may restrict its use in certain areas. The sets must be used in the location declared. Any change of location desired must have prior approval of the licensing authority. A3 (AM radio telephony, 6 kHz bandwith) simplex mode of operation is permitted with a frequency tolerance of 0.005%. The licencee will have to tolerate interference which may be received from operation of industrial, scientific, or medical equipment.

In the International Telecommunication Union's approved frequency sharing services, there is no provision for such a thing called Citizens Band. However, in the international agreements it is stated that spot frequency allocations can be made by the member nations for scientific, industrial and medical purposes. Only under this clause CB type of services are permitted in the USA and other countries.

In the 27MHz band, apart from CB, the industrial equipments, medical and scientific equipments and radio controlled models etc are operating (radio paging in India is given 36MHz band). Hence if the frequency of the CB equipment drifts, it might cause harmful interference to the other users. Due to this stringent requirement, CB equipment assembly by individuals is not generally encouraged. However, if one desires to assemble one's equipment, taking due care of the stringent specifications, one can do so — provided one takes out an experimental licence for assembly. As is well known, even the possession of wireless components in this country requires a licence.

In conclusion, it may be mentioned that if one's interest is purely personal communication (non-commercial), under the existing rules and regulations in our country, it is not worth while going in for CB. For non-commercial local communication amateur radio offers a much better deal at a less cost. ☐

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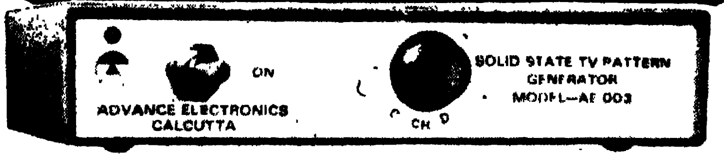

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Interview: K. K. Khandelwal

'Components Industry is in Shackles'

Mr K.K. Khandelwal, managing director of Khandelwal Herrmann Electronics Ltd, Bombay, and president of the Electronic Component Industries Association was in New Delhi recently. Electronics For You took this opportunity to interview him. The excerpts of his interview with the EFY's managing editor are:

Q: *Why is it that we still keep on importing components, even some passive components which are not supposed to be difficult to manufacture?*
A: It's a planning fault. There have been times when the production of certain components has been in excess of the demand, followed by periods when the demand has been in excess of production.

Q: *How is the general profitability of the components manufacturing units in India?*
A: Absolutely low.

Q: *What's the main reason for this?*
A: Capacities of production are very low. Besides, there is a great amount of red-tapism so that you have to have all paraphernalia to satisfy the factory inspectors, state government and central government etc. This paraphernalia would remain the same whether you make one million semiconductor devices or one hundred million devices a year. Its for this reason that our German collaborator is able to produce ten times more than us with just one-third the staff we have. Ultimately, it is the consumer in India who suffers because it is he who has to pay for these inefficiencies imposed on the manufacturers.

Q: *What's the biggest problem facing the electronic components manufacturers today?*
A: Electronics industry in India is being treated like any other ordinary industry. It does not enjoy any special depreciation rate, even though obsolescence rate is very high. Also, the debt equity ratio fixed for this industry by public sector financial institutions is 1:1 only, whereas some industries—like shipping—enjoy a ratio of the order of 9:1. It is for such reasons that people are not coming forward now to set up units for manufacturing electronic components.

Q: *How do you feel about collaborations in the field of electronic components manufacture?*
A: I feel collaborations should be allowed freely because huge investments are involved in research and development. And what we are required to pay to the collaborators are not fortunes. All the countries in the world are allowing collaborations, especially in electronics—as it's a rapidly changing industry—there is no reason why India should not. If collaborations are not allowed, we will be left behind.

Q: *Has the government of India's new import policy for 1978–79 provided any simplification of procedures the industry was hoping for?*
A: No. The electronics industry has rather been singled out to knock at the doors of two agencies—DGTD and the Department of Electronics. For obtaining licences for over Rs 500,000 we will now also have to go to the Department of Electronics. This will certainly result in further delays.

Q: *How do the components manufacturers generally feel about the new import policy?*
A: First of all, the replenishment licences have been totally withdrawn on exports. Even the cash assistance has been slashed, leaving the exporters of electronic components wondering whether the government is at all serious about exports.

With a comfortable foreign exchange position it was anticipated that the raw materials required for the components industry would be placed on Open General Licence. Surprisingly, even those raw materials which were on the OGL last year have now been brought back under the shackles of various controls. On the other hand, the new import policy has opened the flood gates of imports for finished electronic components, without providing the necessary tariff protection. All this has left the exporters of electronic components guessing about the intentions of the authorities. □

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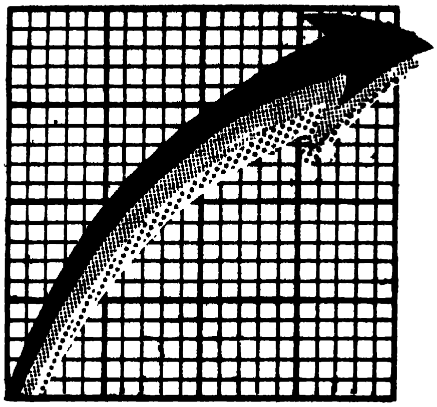


DEPARTMENT OF ELECTRONICS ANNUAL REPORT (1977-78)

The progress of the electronics industry in 1977-78 is set out in the annual report of the Department of Electronics. Given here are brief excerpts of the report highlighting major achievements.—Editor

The total production of electronic items increased from Rs 4100 million in 1976 to Rs 5085 million in 1977 (as shown in Table I), recording a growth of 24 per cent in financial terms on the basis of current prices.

The electronic component sector marginally recovered from its small growth of 7 per cent in 1976 to 13 per cent in 1977. The consumer electronics and mass communication sector registered a record growth of 27 per cent in monetary terms and higher in physical terms during the year. The area of computers, control and instrumentation registered a 60 per cent growth and communication equipment sector nearly 15 per cent; growth in the aerospace and defence equipment sector was marginal.

The radio receiver industry achieved a production of 3.76 million sets during the year, representing a growth of 26 per cent in physical terms. The highlight was a 50 per cent increase in production in the small-scale sector, namely, from 1.3 million sets in 1976 to 2 million sets in 1977 The small-scale sector, for the first time since the setting up of radio receiver industry, surpassed the production of radio receivers by the large-scale units.

The production of TV receivers increased from nearly 0.15 million sets in 1976 to 0.24 million sets in 1977, with production in the small-scale sector representing 75 per cent of the total. Though the production of TV sets in absolute terms increased by 70 per cent, the value-wise increase in production was limited to 50 per cent only, as the average ex-factory value of TV sets decreased further in 1977.

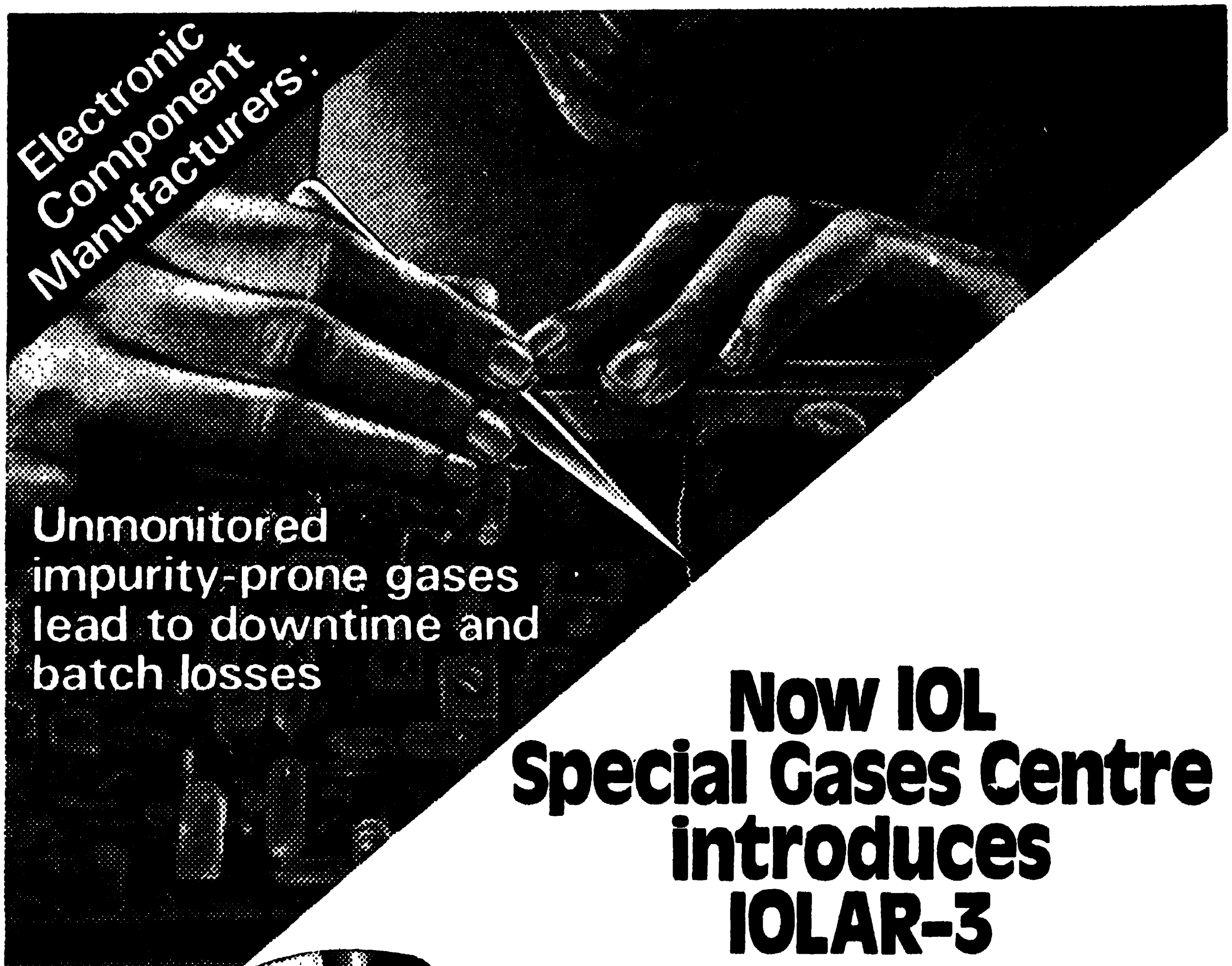
The production of tape recorders increased by 60 per cent during the year from nearly 69,000 numbers in 1976 to 112,000 numbers in 1977. The organised sector registered a 50 per cent growth and the small-scale sector a 90 per cent growth in this area On the other hand, the production of record players increased only by 12 per cent during the year.

The export of electronic items during 1977 grew to Rs 369 million, from the 1976 level of Rs 271 million, thus showing a growth of 36 per cent. The export profile shows a base which is getting diversified as it should be spanning all the major areas of electronics. Apart from consumer electronics which accounts for Rs 82.5 million, major elements in the professional area are defence equipment, principally radars for Rs 110 million and computer software for Rs 25 million.

Profile of the five year plan 1978-83

An important task performed during this year was the preparation of the rolling plan for the electronics sector for the period 1978-83. The working group for this exercise had been constituted by the Planning Commission under the chairmanship of chairman, Electronics Commission. Twenty-two subgroups were set up, one for each ministry having major requirements for electronic equipment.

This exercise has brought out a significant amount of information concerning the type of demand for professional electronic equipment, arising from the activities under the various ministries and departments projected by them in their plans for the duration 1978-83. A report based on this analysis was the basis for the estimates for this sector in the 1978-83 Plan as finalised and submitted to the Planning Commission. The analysis is presented in two parts: (i) activities to be undertaken directly by the Department of Electronics, (ii) activities that will be undertaken by agencies outside of the Department of Electronics. It must be remembered that electronics is a 'derivative' industry in many of its sectors; the total plan allocation for a particular area, e.g. defence, civil aviation, has to be defined before the electronic components of it can be specified. There is thus a process of iteration which has to be carried out. The Planning Commission has asked the Department of Electronics to carry out the next level assessment, based on plan allocation as presented to the National Development Council and have this available by June 30, 1978.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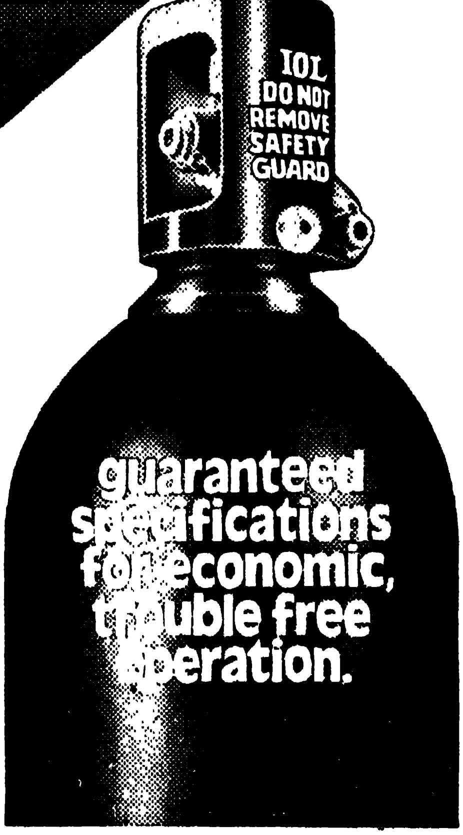
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TABLE I

PRODUCTION OF ELECTRONIC EQUIPMENT AND COMPONENTS (IN RS MILLION)

Calendar year	*Consumer electronics & mass communication*	*Communication equipment*	*Aerospace & defence equipment*	*Computers, control & instruments*	*Equipment total (Columns 2 to 5)*	*Components*	*SEEPZ production for exports*	*Equipment & components total (columns 6+7+8)*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1977	1305	1260	550	1025	4140	905	40	5085
1976	1030	1100	500	640	3270	800	30	4100
1975	845	970	490	585	2890	750	5	3645

Note:
1. Production figures have been rounded up to the nearest five million digit.
2. Production figures for calendar year 1975 and 1976 are given for comparison purposes.
3. Prices given have not been normalised to any base year. They are the prevailing prices.
4. The table only shows production and growth in financial terms; there has been a significant fall in the prices of several items and a marginal increase in the prices of several others.

Indian National Satellite (INSAT) System

Based on various options for the space and ground segments of the multi-service geostationary national satellite (INSAT) worked out by an inter-departmental group, the government decided, in July 1977, to go in for an operational and stand-by satellite pair, each providing the full range of services for communication, meteorology and TV, but to restrict the ground segment at present to only that needed to use the communication and meteorological segments of the satellites. Based on that decision procurement action for the satellite pair, launch, and associated ground control facilities has been taken by the Department of Space.

The ground segment, relating to communications, which consists essentially of 35 earth stations, is the one involving the largest outlay amounting to Rs 480 million. The first 7 of these, which are to work with the satellite transmitter leased by the P&T Department from the INTELSAT-IV Indian Ocean satellite, in order to provide communication to remote areas such as Andamans and Leh, have had to be imported because of the tight time frames involved. Efforts are being made for getting as many of the remaining 28 stations as possible through indigenous production in regard to both antennae by ECIL and electronics by ITI.

Satellite Telecommunications Experiments Project (STEP)

This collaborative project involving the Department of Space and the Ministry of Communications on the Indian side went into operation in June 1977. The project utilises the geo-synchronous Franco-German telecommunication satellite 'Symphonie', to carry out experiments in the field of satellite telecommunication in India; as part of this experimental telecommunication, links between some metropolitan areas and selected remote locations in the country have been established.

In addition to setting up three fixed earth stations in Ahmedabad, Delhi and Madras, a transportable remote area communications terminal and an emergency communication terminal have also been deployed; the latter was used in the cyclone affected area of Andhra Pradesh where two-way communications were established within a very short period. This project has demonstrated the national capabilities and provided experience in the area of satellite communication; and has involved a significant development in the field of professional electronics. The Department of Electronics is represented on the STEP policy committee.

Defence electronics

Under the Department of Defence Production, electronics equipment and components are produced by

(i) Bharat Electronics Ltd (BEL) in its factories at Bangalore and Ghaziabad. (In addition, a unit is being set up at Pune)

(ii) Hindustan Aeronautics Ltd (HAL) in its factories at Hyderabad and Lucknow.

(iii) Bharat Dynamics Ltd (BDL) in its factory at Hyderabad.

Whilst these units cater mainly for the needs of the

Punjab Semiconductor Devices Limited

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PRICE LIST

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Sr. No:	Type	Description	EX-FACTORY PRICE	
			Wholesale Rs. P.	Retail Rs. P.
1.	1N 4001	Si. 50V, 1A, rectifier	0.85	1.05
2.	1N 4002	Si. 100V, 1A, rectifier	0.90	1.15
3.	1N 4003	Si. 200V, 1A, rectifier	1.00	1.25
4.	1N 4004	Si. 400V, 1A, rectifier	1 10	1.40
5.	1N 4005	Si. 600V, 1A, rectifier	1.30	1 65
6.	1N 4006	Si 800V, 1A, rectifier	1.50	1 90
7.	1N 4007	Si. 1000V, 1A, rectifier	1.80	2.25
8.	PBY 127	800V, 1A, Si. mains rectifier for professional use	3.55	4 45
9.	PBY 126	450V,1A, Si. rectifier for professional use	3.10	3.90
10.	PBY 125	100V, 1A, Si. rectifier for professional use	1.50	1.90
11.	PDR 50	Si. 50V, 200 mA, rectifier	0.75	0.95
12.	PDR 25	Si. 25V, 250 mA, rectifier	0.75	0.95
13.	PDR 300	Si. 300V, 300 mA, switching rectifier	3.25	4.10
14.	PDR 301	Si. 100V, 300 mA, switching rectifiier	2.30	2.90
15.	PDR 302	Si. 100V, 150 mA, 350 nano seconds, switching rectifier	2.30	2.90
16.	PSD 4148	Si. 75V, 75 mA, 500 nano seconds switching diode	1.00	1.25
17.	PBYX 55	Si. 500V, 1A, 350 nano seconds switching rectifier	5.00	6 25
18.	PBYX 71	500V, 7A, 450 nano seconds switching rectifier (TO-3)	11.00	13.75
19.	PFR 103 N&P	Si. full wave rectifier 3A, 100V in TO-3 outline	10.00	12.50
20.	PFR 203 N&P	Si. full wave rectifien 3A, 200V in TO-3 ontline	11.00	13.75
21.	PFR 107 N&P	Si. full wave rectifier 7A, 100V in TO-3 outline	13.50	16.90
22.	PFR 207 N&P	Sil. full wave rectifier 7A, 200V in TO 3 outline	15.50	19.40
23.	PFR 115 N&P	Si. full wave rectifier 15A, 100V in TO-3 outline	16.00	20.00
24.	PFR 215 N&P	Si. full wave rectifier 15A, 200V in TO-3 outline	18.00	22.50
25.	PFR 130 N&P	Si. full wave rectifier 30A, 100V in TO-3 outline	25.00	31 25
26.	PFR 230 N&P	Si. full wave rectifier 30A, 200V in TO-3 outline	27.00	33.75
27.	2N 3055	60V (VCEO), 15A, 117W power transistor in To-3 Outline	14.75	18.45
28.	2N 3055×2	Matched Pair	30.00	37.50
29.	2N 6253	45V (VCEO), 15A, 117W power transistor,	12.75	15.95
30.	2N 6371	40V (VCEO), 16A, 117W power transistor	12.00	15.00
31.	2N 3054	29W power transistor in TO-66 outline	9.25	11.55
32.	PHR 5007 N&P	50V, 7A, rectifier in TO-3 outline	6.00	7.50
33.	PHR 107 N&P	100V, 7A, rectifier in TO-3 outline	7.00	8.75
34.	PHR 207 N&P	200V, 7A, rectifier in TO-3 outline	7.50	9.00
35.	PHR 115 N&P	100V, 15A, rectifier in TO-3 outline.	8.00	10.00
36.	PHR 215 N&P	200V, 15A, rectifier in TO-3 outline	8.50	10 25
37.	PBF 200	Forward gain controlled transistor for V.H.F. tuners/boosters	6.20	7.75
38.	PBF 167	Forward gain controlled transistor for vedio I.F. (TO-92)	5.25	6.60

Sr. No :	Type	Description	EX-FACTORY PRICE Wholesale Rs. P.	Retail Rs. P.
39	PBF 173	Video IF transistor for TV (TO-92)	5.00	6.25
40.	PBF 177	Video output 100V (VCBO) transistor for TV (To-39)	6.00	7.50
41.	PBF 178	Video output 185V (VCBO) transistor for TV (TO-39)	7.00	8.75
42.	PBF 179	Video output 250V (VCBO) transistor for TV (TO-39)	8.00	10.00
43.	2N 918	UHF amplifier/oscillator transistor (TO-92)	4.75	5.95
44.	PBF 194/195	RF/IF transistor (TO-92)	1.60	2.00
45.	PBF 194/195/BCD	RF/IF transistor (TO-92)	1.90	2.40
46	BC 148C	High gain audio transistor	1.60	2.00
47.	BC 149C	Low noise high gain audio transistor	2.00	2.50
48.	HF Pack	3 nos of PBF 194/195/BCD	4.85	6.10
49.	PBZ 6	6.2V, 250mW, ±10% zener diode (TO-92)	0.95	1.20
50.	PBZ 6 A	6.2V, 250 mW, ±5% zener diode (To-92)	1.45	1.80
51.	PBC 147A	Si. 50V, 200 mA Audio transistor (TO-92)	1.15	1.45
52.	PBC 148A	Si. 30V, 200 mA Audio transistor (TO-92)	1.15	1.45
53.	PBC 147B	Si. 50V, 200 mA Audio transistor (TO-92)	1.35	1.70
54.	PBC 148B	Si. 30V, 200 mA Audio transistor (TO-92)	1.30	1.65
55.	HF Pack+PBC 147A/148A	Sepcially selected transistors for radio	5.65	7.10
56.	HF pack+PBC 147B/148B	—do—	5.70	7.15
57.	HF pack+2 nos of PBC 147A/148A	—do—	6.65	8.35
58.	HF pack+ PBC 147A/148A+ PBC 147B/148B.	—do—	6.75	8.45
59.	HF pack +2 nos. of PBC 147B/148B	—do—	6.85	8.60
60.	IN 752	5.6V±10%, 400 mW, axial zener diode	3.00	3.75
61.	IN 752A	5.6V± 5%, 400 mW, axial zener diode	3.50	4.40
62.	IN 753	6.2V±10%, 400 mW, axial zener diode	3.00	3.75
63.	IN 753A	6.2V± 5%, 400 mW, axial zener diode	3.50	4.40
64.	IN 754	6.8V±10%, 400 mW, axial zener diode	3.00	3.75
65.	IN 754A	6.8V± 5%, 400 mW, axial zener diode	3.50	4.40
66.	IN 755	7.5V±10%, 400 mW, axial zener diode	3.00	3.75
67.	IN 755A	7.5V± 5%, 400 mW, axial zener diode	3.50	4.40
68.	IN 756	8.2V±10%, 400 mW, axial zener diode	3.00	3.75
69.	IN 756A	8.2V± 5%, 400 mW, axial zener diode	3.50	4.40
70.	IN 757	9.1V±10%, 400 mW, axial zener diode	3.00	3.75
71.	IN 757A	9.1V± 5%, 400 mW, axial zener diode	3.50	4.40
72.	IN 758	10V±10%, 400 mW, axial zener diode	3.00	3.75
73.	IN 758A	10V± 5%, 400 mW, axial zener diode	3.50	4.40
74.	IN 759	12V±10%, 400 mW, axial zener diode	3.00	3.75
75.	IN 759A	12V± 5%, 400 mW, axial zener diode	3.50	4.40
76.	PSD 50	50V, 25 mA diode (TO-92)	0.60	0.75
77.	PSD 12	12V, 25 mA diode (TO-92)	0.55	0.70
78.	PSD 40	40V, 50 mA, 200 nano sec., fast switching diode (TO-92)	2.20	2.65
79.	BD 160	250V (VCBO), 5A, 700 nano sec. power transister (TO-3)	25.00	31.25
80.	PBY 184	1800V, 100mA peak current diode	5.00	6.25

The above prices are subject to 5% service charges for deliveries from offices at Delhi/Bombay/Bangalore. Local taxes extra.

For deliveries outside Chandigarh, 4% CST against 'C' Form and 1% handling and insurance charges will be applicable.

Wholesale prices will be applicable for a billing of 300 pieces or more at a time.

defence services, they are also diversifying to meet the requirements of other users like police, post & telegraphs, state electricity boards, information & broadcasting, civil aviation, meteorology and oil.

A wide range of components manufactured by BEL are used by all sectors of the electronics industry. Equipment, sub-assemblies and components required for defence applications are also procured from the Indian Telephone Industries (ITI), Electronics Corporation of India Ltd (ECIL) and Instrumentation Ltd (IL) in the public sector, as well as from private sector units. Small-scale critical requirements are also met from batch production facilities established at a number of laboratories. Out of the total electronics production of Rs 5085 million, Rs 538 million was on account of defence electronics requirements during the calender year 1977.

Promotion through state initiative

Considerable progress has been made in promoting the development of the electronics industry in a geographically balanced manner in the various states, with special emphasis given to those states which were less developed in this regard. For this purpose, the Department of Electronics utilises a number of mechanisms in addition to initiatives through the central public sector corporations located in the state concerned. It has promoted the setting up of dedicated state electronics development corporations as lead agencies for electronics in their states which can be made responsible for setting up industrial projects in the public and joint sectors, running industrial estates, providing marketing support to small-scale units and organising and operating test & development centres in the state for which support is given by the Department of Electronics.

The department permits, on its own initiative, projects in both the large and small-scale sectors to be executed directly by private entrepreneurs; for this, specialists from the department and IPAG conduct regular discussions both in Delhi and in the state with the concerned parties. State-level electronics development corporations were set up during the year by the states of Maharashtra and Tamil Nadu.

Import review of electronic systems and equipment in general

During 1977-78, some 80 proposals for import of electronic systems/ equipment (other than computers) and spares for systems/equipment imported earlier, involving a total money value of around Rs 252 million, were received from a wide range of users: defence, P&T, civil aviation, AIR, Doordarshan, central and state ground water boards, India Meteorological Department, etc. As a result of a review of these proposals, and active promotional work undertaken by the department, a number of requirements were diverted to domestic supply. One example is the approximately Rs 11 million worth of high technology systems and equipment needed for project MONEX, details of which are given somewhere later. Another instance was that of electronic well logging equipment for groundwater exploration, to support the expanding irrigation programme.

As a result of the import review, combined with tapping expertise built up earlier in the Institute of Petroleum Exploration of the ONGC, and the provision of approximately Rs 1.8 million worth of R&D grants by the department to the institute for the development of such logging equipment, it is expected that the 40-50 systems worth approximately Rs 30 million needed by the Central Groundwater Board (CGWB) alone, over the next five years, are now likely to be met from indigenous sources. To this would be added the requirements of the various state groundwater boards, which are currently being surveyed in detail by the CGWB.

Digital time base correctors, an important equipment needed in TV studios, developed by the Space Applications Centre, Ahmedabad, and to be manufactured by Gujarat Communications and Electronics Ltd, a public sector enterprise of the government of Gujarat, is yet another example of the promotion of domestic production as a result of the import clearance procedure. So also is the manufacture and supply, in record time, of special antennae needed for the UHF radio communication system being set up by the ONGC for communication and control between the off shore oil platforn s in Bombay High.

The import clearance system also enables the department to take action to replace an older technology system or sub-system by one which is not only based on newer technology, but is, in addition, developed and manufactured within the country. Video mappers needed for surveillance radars being made by HAL, Hyderabad is one such example. Here, as a result of the department providing an R&D contract to a competent laboratory, an optical mapper originally proposed to be imported by HAL is now to be replaced by an electronic digital mapper which is more compact and reliable and which would also result in additional indigenous production to the tune of Rs 6 million over the next five years. Another instance is the radio frequency preamplifier needed for the same surveillance radars, where import substitution initiated by the department as a result of an import clearance application will not only reduce costs but also avoid maintenance problems.

Several cases involving import substitution of spares for equipment already in use also took place during the year. Spares for distance measuring equipment for the Civil Aviation Department, TV transmitters and TV studio equipment of Doordarshan are examples of such cases.

Import review of components and materials for electronics manufacturing programmes in the public sector

The department continued to review and clear applications for import of electronic components and materials from central public sector companies engaged in the manufacture of electronic equipment. About 50 such applications were dealt with, involving a total import bill of professional grade electronic, electro-mechanical, and allied components worth Rs 330 million cif. which is approximately the same level as in 1976-77.

The direct import substitution achieved this year was about Rs 40 million in money value in relation to about Rs 20 million in 1976-77. However, the qualitative impact of the programme was much wider. As indicated in last year's annual report, the purpose of this effect is basically threefold: to build up an accurate, micro-level information base on the current and projected needs of public sector companies (who produce the overwhelming proportion of high technology professional electronic equipment and systems) for professional grade components (i.e those necessary for defence, communication and computer systems); to bring about a continuing interaction between component manufacturers and these public sector equipment producing companies and to close the information gaps between them; and, to systematise and intensify the indigenisation of electronic subsystems and systems manufactured in the country. Towards these ends, a major meeting between component manufacturers and public sector equipment manufacturers was arranged at DGTD at which a free and frank discussion of technical production, quality control, procurement and forward planning issues took place. Apart from this large meeting several smaller meetings on specific import application cases between concerned equipment and components manufacturers were also arranged by the department during the year.

As a result of these interactions, and the provision by the Department of Electronics over the last two years of increasing amounts of information to component manufacturers about the precise requirements of equipment manufacturers for particular components, several new components have become available from domestic production. What is more, in many cases, multiple sources of such component supplies have been built up, thereby widening the production base and promoting competition and assurance of supplies. Some examples are: military specification circular connectors, radio frequency coaxial connectors, polystyrene capacitors and switching transistors.

A beginning has also been made in the indigenous production of high-value passive microwave components needed in sophisticated and sensitive systems like radars and troposcatter and satellite communication systems. Reed switches, a basic component involved in the manufacture of electronic telephone exchanges, is another example. Promotional work with manufacturers of this component, undertaken as a result of an application for its import from a public sector company has led to the development and batch production of reed switches which meet the specifications. As a result, approximately Rs 1.5 million worth of imports of this component were diverted to domestic sources during the year itself. What is more, this effort will result in a large amount of import substitution when the manufacture of electronic exchanges for both the defence services and the P&T now being launched gathers momentum in the next 2–3 years. Many more such examples could be given.

Computers

There was a considerable increase in computing power in the country during 1977-78. During the year, the Department of Electronics has been adopting more detailed procedures with regard to procurement of computer systems through import. Cases for 32 systems, as compared to 24 cases during the last financial year, were processed for import through the Approvals Committee. Major evaluation exercises for regional facilities, banking, large commercial organisations and production units and on-line process control were carried out during the year.

In the field of software, apart from a national seminar organised at Hyderabad, a meeting of software experts from India with their counterparts in the European Economic Community countries was organised at Brussels in November 1977 under the aegis of the Indo-EEC Joint Commission. This meeting has evoked considerable interest for software export in the EEC region and is being followed up through a visit of experts from the EEC region to India in March 1978. A number of entrepreneurs have been permitted import of suitable systems for building up software export programmes.

An advanced programme on computer-based systems analysis and design for computer professionals has been organised by the Indian Institute of Management, Ahmedabad, with support from the Department of Electronics. Another programme has been approved at the Administrative Staff College of India, Hyderabad. Based on the result of these courses, similar courses are being started in other institutions also. A seminar on the use of Indian languages in computers has been planned to be organised shortly.

The Computer Maintenance Corporation, a public sector undertaking of the Department of Electronics, has been assigned the major task of offering maintenance for all IBM systems irrespective of their location, size, configuration or age consequent to the IBM decision to

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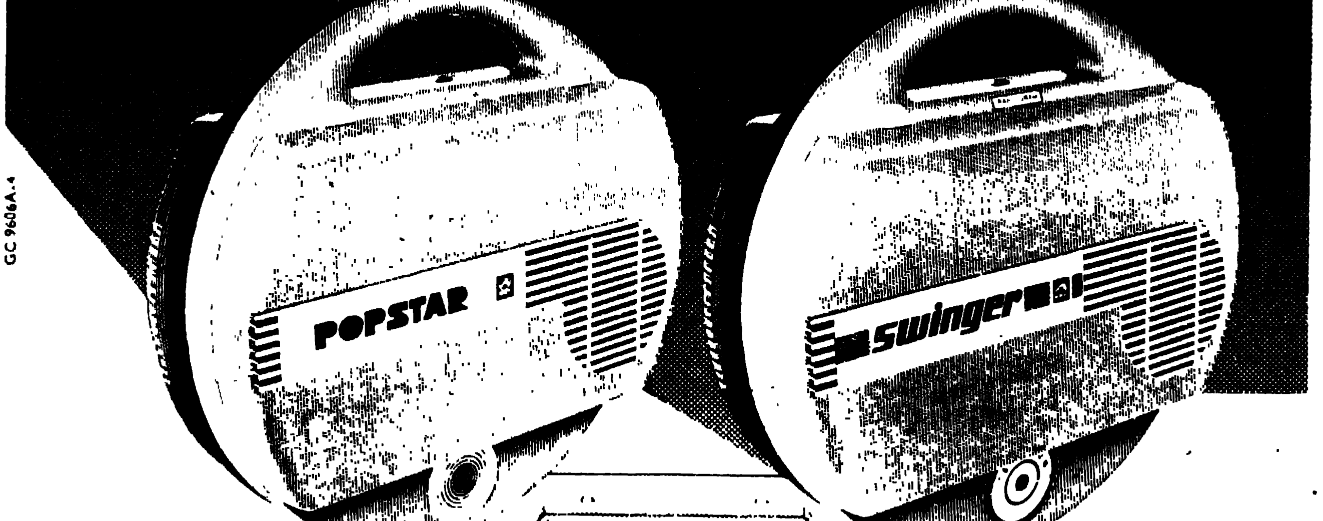

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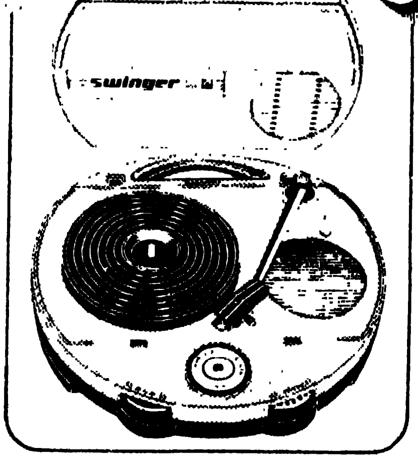

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withdraw from these operations from June 1, 1978. Government policy framework for licensing and for making the minicomputers and microprocessors industry more broad-based has been formulated.

One of the principal activities of the Department of Electronics is the promotion of appropriate computerisation through Regional Computer Centres. The Regional Computer Centre at Calcutta is being utilised by over 50 organisations. A significant development during the year was the installation of an inter-city computer to terminal data link over a distance of about 500 kms. This data link connects the terminal located at Metallurgical Consultants Limited (MECON), Ranchi to the computer at the Regional Computer Centre, Calcutta. Work is in progress in designing other regional computer centres at Kanpur, Lucknow, Chandigarh, Pune and Bangalore. The National Centre for Software Development and Computing Techniques (NCSDCT) continued its programmes in education, training, promotion of applications and technology development as also generation of software tools, etc. Significant planning and promotion work has gone into the aspects related to the data communication technology and information security.

Telecommunications

The role played by the department involves looking at telecommunications plans and projects from the electronics angle. For example, if the Ministry of Communications plans to manufacture electronic exchanges, the department looks at the requirements of electronic components and computer technology so that when the electronic exchanges are made within the country, it has the maximum indigenous content. As the department is keen to see that, to the extent possible, the production base for communication equipment is enlarged and diversified to ensure reduced imports, greater self-reliance, surplus capacity for exports and different approaches in terms of technology and management, it assisted BEL and ECIL and certain state electronics development corporations to go into this area.

The department also assisted major users like the Central Electricity Authority (CEA) in planning and coordinating the future expansion of the communication and telecontrol requirements of the regional electricity boards. During the year, the Department of Electronics examined a number of proposals for the procurement of large quantities of load despatch equipment and power line carrier equipment required by these. The department is now assisting the CEA to constitute a suitable system management group to undertake the planning, analysis, installation, commissioning, acceptance testing, maintenance and system engineering of the equipment being acquired in this sector.

Project TITAN

Oil production and transportation, whether offshore or onshore, requires sophisticated communication, telemetry and telecontrol equipment for efficient operation. Last year's annual report indicated in some detail how the Department of Electronics promoted, in collaboration with the ONGC, a project providing a sophisticated multi-element communication, control and data handling system for use within ONGC's Bombay High offshore oil fields. This Rs 25 million system which, in terms of nature and scope of facilities and sophistication of technology, is likely to be one of the first of its kind in the world, is being executed for the ONGC on a turn-key basis by the Radar and Communications Project Office (RCPO) of the Ministry of Defence. Considerable progress was made on this project during 1977-78.

Based on the overall design and detailed engineering of each segment of the total system, RCPO took action to procure the equipment from both foreign and domestic suppliers, and deliveries have already started. Installation and commissioning on the offshore platforms is now being done and after testing and check out, the basic system is expected to become operational towards the end of June 1978. Full computer-based control would come in towards the end of 1978, in the light of the experience gained and data collected with the basic system.

Project MONEX

With the completion of the Indo-Soviet Monsoon-77 experiment in the second quarter of the calendar year 1977, detailed programming was initiated for our participation in the main international Monsoon Experiment (MONEX) to start in May 1979. Being a member of the MONEX Management Committee, the Department of Electronics was fully involved in this exercise. As indicated in last year's annual report, a major objective of the Department of Electronics has been to use the opportunity provided by the time-bound MONEX project to boost electronic production relevant to the areas of meteorology and oceanography involved in the programme in a manner which simultaneously broadens the base of development, manufacture and supply of such equipment to the India Meteorological Department, the Navy, ONGC and other agencies in future. Considerable success has been achieved by the Department in this regard.

A combination of regulatory and promotional efforts and the support of other members of the Electronic Equipment and Instruments Sub-committee of the MONEX Management Committee, has led to several major items of equipment needed for MONEX-79 being committed for supply on the basis of indigenous design and production. The most important of these are: Rs 3.7 million worth of radiotheodolites used for wind parameters

measurements, Rs 4.2 million worth of special computer-based 3-dimensional radar scanning systems which will steeply enhance the capability of the weather radars of the India Meteorological Department at Calcutta and Madras to be used during MONEX, Rs. 3.5 million worth of a ship-borne data logger to operate on the oceanographic survey vessel 'INS Darshak' which will be our lead vessel during MONEX. While the first two systems are being developed and produced by the Special Microwave Products Unit (SMPU) at the Tata Institute of Fundamental Research, Bombay, the ship-borne data logger is being supplied by the systems group of the Department of Electronics itself. In collaboration with the MONEX Directorate, the Department of Electronics will closely monitor the progress of all these projects during 1978-79 so as to ensure that they are delivered in time and to the requisite technical specifications.

Medical electronics

In the area of medical electronics, an experiment of some consequence has been initiated at Ballabhgarh. This project is jointly managed by IPAG and the All India Institute of Medical Sciences. The project aims at setting up a hierarchical communication network at Ballabhgarh block. After studying the terrain, distribution of primary health centres and extension health centres, a communication network has been designed. It was decided to set up, on a pilot scale, transreceiver stations at Ballabhgarh, Dayalpur and Chhansa long with mobile stations in the form of medically equipped vans.

The reasons why IPAG took the initiative in the experiment are: firstly, it is a new concept; secondly, it is a promotional effort with possible nationwide benefit; and thirdly, it is in line with the priorities set by the government for enhancing facilities in rural areas. The pilot scale system is operational and already reports have started coming in so that emergency cases in some villages have been successfully handled using this pilot facility. It is planned to enlarge this concept as soon as the department makes an assessment of the project after one year of continuous operation.

Industrial electronics

Among the various sectors of professional electronics, control instrumentation and industrial electronics has acquired special significance because of its diverse application areas. The department continued to play a role in promotion of this sector of the industry. Though its involvement has been substantive in a number of cases, a few examples are outlined here.

The department has initiated a project on instrumentation and control for the sugar industry at CEERI, Pilani and the National Sugar Institute, Kanpur. As recommended by the panel on mining electronics, due importance has been given to manpower training and two such programmes were initiated at the Indian School of Mines, Dhanbad, and Orissa School of Engineering, Cuttack. The department has initiated indigenous development of water loggers required by the Central Ground Water Board and many others by providing the necessary development funds. This process is expected to save several million rupees in foreign exchange in the coming years.

A major exercise was undertaken in collaboration with BHEL to select the instrumentation and control systems for the Rourkela and Bokaro Steel Plants. In the cement sector, at the request of the Cement Corporation of India, IPAG assisted them in the technical evaluation of instrumentation and control panels for their three cement plants at Akaltala, Neemuch and Yerraguntla.

Components and materials

During 1977, shortage of certain types of components such as valves, carbon-film resistors, electrolytic capacitors, ceramic capacitors and plastic-film capacitors was observed. In response to the representation by TV manufacturers about long delivery schedules quoted by component manufacturers, IPAG was asked to make a detailed analysis. This analysis showed that the demand and supply position was tightly balanced for these components and it would be further aggravated by a very large growth in demand from the TV industry. As a result, a limited import of these components was allowed to actual users to overcome the immediate shortage.

Certain long-term measures to increase production, mainly of quality components, are also being taken. Some of the important activities initiated by the Department of Electronics were to set up pilot plants for production of low-volume sophisticated items involving high cost and large R&D efforts. The projects currently in progress include: copper-beryllium alloy plant, special microwave components and systems, and special electron tubes. Work on the pilot plant for making beryllium and copper-beryllium alloy at Vashi, Bombay, has been initiated in collaboration with the Department of Space and Atomic Energy. At the Special Microwave Products Unit, which will be run by the Department of Electronics as an R&D-intensive experimental factory, work is in progress on the custom manufacture of radiotheodolite and weather radar scanning attachments for the project MONEX. The unit has also taken up development and trial production of some special microwave components for defence equipment.

IPAG and ELCINA collaborated in identifying the problems of the electronic components industry, especially from the point of view of identifying the optimal level of fiscal incentives like depreciation allowance. In pursuance of this, IPAG prepared a detailed analysis and made certain recommendations. The department is persevering in its attempt to provide a higher depreciation allowance for the electronic components industry.

TABLE II
Production Trends in Selected Electronic Components
(In Organised Sector) (Rs million)

Components	*1975*	*1976*	*1977*
Electron tubes			
Receiving	35.41	30.64	33.51
Transmitting	14.84	15.90	18.12
TV picture	38.74	26.72	38.97
Others	8.80	12.34	13.14
Semiconductor devices			
Transistors & diodes	130.14	103.87	129.73
Integrated circuits	6.15	6.49	8.27
Others	22.32	25.00	27.45
Resistors			
Carbon-film	12.46	10.90	13.32
Potentiometers	8.73	11.24	13.32
Others	2.57	3.89	4.23
Capacitors			
Ceramic	12.20	13.28	14.88
Plastic-film	15.75	18.85	24.31
Electrolytic	16.49	19.25	24.31
Others	19.55	36.28	39.48
Electromechanical			
Connectors	11.24	10.49	12.59
Relays	10.78	11.42	13.80
Switches	9.31	9.59	12.86
Other Components			
Loudspeakers	23.80	26.30	30.28
Crystals	13.30	12.01	11.77
Hard ferrite	5.06	7.12	10.51
Soft ferrite	5.52	7.20	6.73
Permanent magnet	19.84	22.25	30.92
Miscellaneous components	21.60	22.96	25.14
Total	464.60	463.99	557.64

Export promotion

A major export programme recently started is that relating to sophisticated radar equipment. The credit for this should go to Bharat Electronics Limited who, in the last four years, has embarked upon a substantially high level of R&D. Such exports are possible only by organisations with a deep-rooted R&D culture and quality consciousness Recognising this, the Department has funded a number of research and development projects in BEL, ECIL and ITI to strengthen their R&D infrastructure.

The defence and aerospace electronics exports have now crossed the Rs 100 million mark. Export of computer software is also being promoted. Special efforts in this connection have been initiated with USSR and the East European countries and with the EEC countries. Apart from this, private sector software export and computer imports for software export have been encouraged.

The Electronics Trade and Technology Development Corporation (ETTDC) is consciously building up an infrastructure to promote exports from the private sector, particularly the small-scale sector. When promising product lines are discovered which can be converted to export-grade with marginal developmental efforts, the Department of Electronics, through the ETTDC, considers funding such units for upgrading them to export viable levels. A few projects of this type were already initiated during the year; they include development projects on AM and FM receivers, telephone subscriber instrument meeting CCITT specifications, low-cost TV receiver, etc.

The performance in exports by ETTDC itself during the year has been substantially higher than that in the previous year with a turnover of more than Rs 5 million. The items exported increased from 2 to 20 and consist of a range of items like voltage stabilisers, telecommunication equipment, scientific calculators and computer software. To promote exports, the Department of Electronics, through ETTDC, arranged for participation in exhibitions and trade fairs abroad. Many of these participations were fruitful and many orders were realised by various parties which are directly attributable to participation in these trade fairs.

Promotion through corporations under Department of Electronics

As a commercial organisation, ETTDC has enlarged its operations from Rs 8.76 million in the first year to Rs 17.91 million in the second year and Rs 64.90 million in the third year. It is now aiming at significant export ventures and several initiatives are being taken towards this. ETTDC plans to have a limited production base of its own for this export drive and also a quality assurance service.

ETTDC also entered a new phase in its activities by taking on a number of technology development programmes. Two typical projects taken up by them in collaboration with the private sector units are data line monitor and microprocessor based business accounting and invoicing machines. These are import substitution activities.

The Computer Maintenance Corporation (CMC) is gearing itself up to take on the servicing of IBM computers with effect from June 1, 1978 when IBM will cease its activities in India. CMC has also taken on the maintenance of several IBM, ICL and Robotron computers. The corporation executed a memorandum of understanding with IBM in November 1977 to facilitate smooth transfer of the latter's activites. The amount of organisational and technical efforts being mobilised by the corporation is apparent trom the fact that from less than 10 systems, the corporation would maintain nearly 1000 different computing unit record/data preparation systems by June 1978. An R&D wing has been established at Hyderabad with responsibility for improving the life and performance of the systems already installed in the country.

Semiconductor corporation

The semiconductor complex was incorporated during 1977-78. It has acquired land for setting up its production cum R&D centre at SAS Nagar in Mohali (near Chandigarh) in Punjab. Work on the design of buildings has been completed; construction will start shortly. It has set up a microprocessor laboratory and a computer-aided design facility as nucleating activities. ☐

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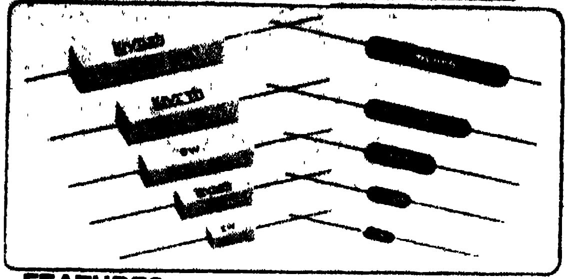

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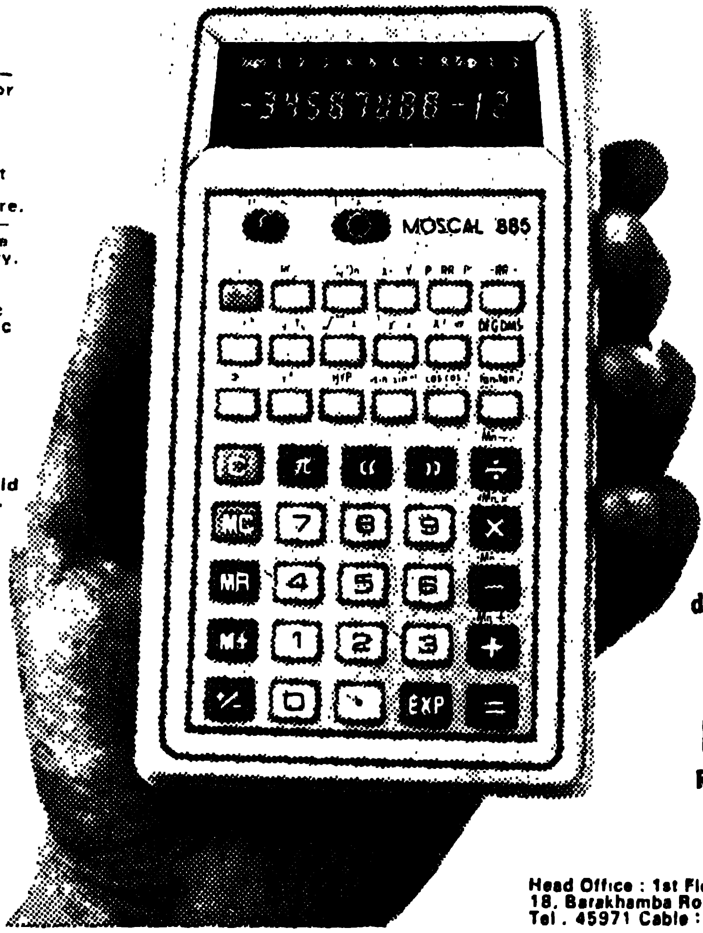

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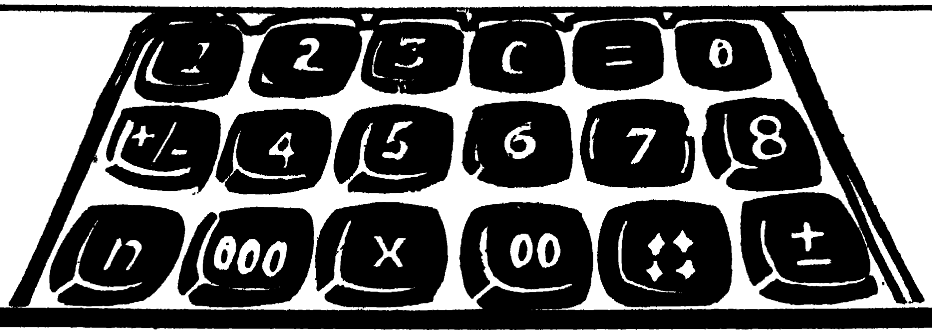


ELECTRONIC CALCULATORS INDUSTRY IN INDIA

ELECTRONIC CALCULATORS: A NEW WAVE

It may be recalled that in 1975 Perspective Report on Electronics in India was published by the Electronics Commission. It was indeed a voluminous report which extended over 690 pages. Strangely, the authors of this report did not consider the manufacture of electronic calculators important enough to be mentioned in this report.

Not that they were not aware of the fast progress that this industry had made all over the world. But since the report was designed to set out prospects for 1985, perhaps the authors believed that it would take a much longer time for the electronic calculators to be manufactured in our country in a significant way.

Is an electronic calculator a novelty in India even today? The answer is definitely in negative because it has thrown out of use almost all the old mechanical as well as electrical models of calculating machines. May be some institutions and universities are still making use of the old calculating machines, but the new age has struck all the places of learning where statistics and economic research is conducted. Surely, the number of electronic calculators in use is not large; but there is no doubt that rapid stride that has been made all over the world in this regard will overtake this country also within the next couple of years.

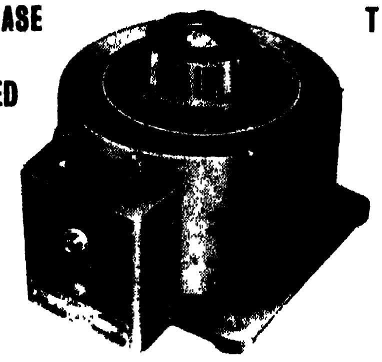
What are the basic ingredients which go to the making of electronic calculators. They are such vital components as LED and LCD displays, IC chips and high-quality keyboards. The bulk of these components are currently imported from abroad, though attempts are being made by several units to manufacture them in this country with an accent on improved quality. A government of India unit set up in the neighbourhood of Delhi - Sahibabad (U.P.) — has introduced its own LCD displays which may be used in calculators. This unit is also planning to produce LED displays.

Statistics relating to the manufacture of electronic calculators in this country in 1977 do not appear to be very inspiring because there was a rise of only 12 per cent in 1977 over 1976. Earlier, starting from a very low base, the percentage was much higher. However, the excise duty relief provided by the finance minister in the budget is expected to bring down the price of pocket calculators in particular. It has been observed that electronic products in this country are price-elastic to a large extent. It means that a 10 per cent reduction in price increases the size of the market by more than 10 per cent. The same is true in regard to electronic calculators as well.

It is conceded that we have nearly 20 regular manufacturers of electronic calculators in our country whose average production works out to about 3000 pieces a year only. Despite our emphasis on small-scale industries this is indeed a pitifully low level. This low volume of production also explains, in part, the reasons for the high price of calculators in our country as compared to those prevailing in the foreign markets.

A couple of years ago the government had issued licences for the manufacture of electronic calculators to some new units under an obligation to export over 60 per cent of their production. This linkage also increased the price of the calculators marketed within the country, because the 'losses' incurred in exports are also passed on to the domestic consumers.

In the short period this is unavioidable, but because this cannot go on for too long, the Indian manufacturers have to take upon the challenge of producing calculators at prices which are competitive in the markets of the world. Then and then alone the electronics industry can raise its head with pride in the galaxy of nations which have acquired a high status in the markets of the world. □



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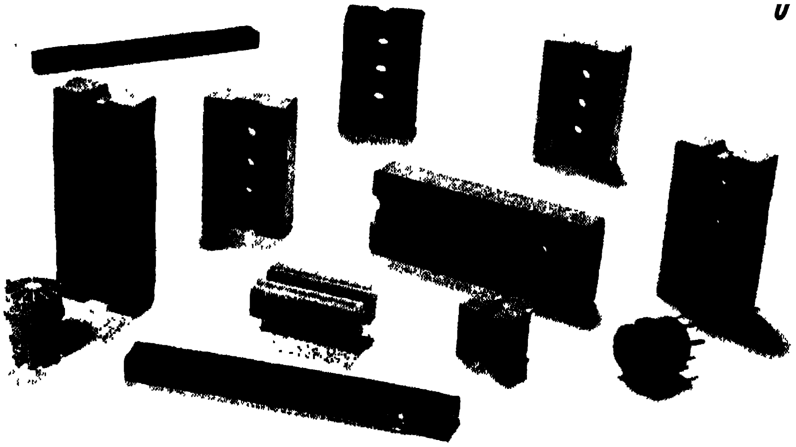

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Calculators—A Study of Market Trends

Arun Bhatia
Managing Director, Calcom Electronics

After an overwhelming performance abroad in many countries, calculators have finally gained a very important foothold in this country and are here to stay. Prices, which had been earlier showing a very unpredictable downward trend, much to the dismay of distributors and stockists, are now showing a very healthy stability — typically indicative of a mature and stable product. This trend has also been the same in the international market, except that in some more prominent and advanced markets like Japan and Hong Kong (for the small, popular calculators) the trend normally leads our trends by about six months to a year.

In the international market,prices have been generally very stable during the recent past and have lately shown some upward tendencies. The upward trend can be attributed to a number of reasons. Among these are demand saturation to some extent, new display technology of LCD gaining popularity in the consumer segment, walking out of some important manufacturers (particularly in Taiwan and Hong Kong) from the calculator line, currency fluctuations — especially the sharp upward revisions in the yen rate.

Demand saturation in the international market was very much in the offing because initially a very large number of manufacturers, particularly from Taiwan and Hong Kong, had been active in the field. These manufacturers were motivated by the profit margins and the ready market but were not dedicated to this line by way of its technology. They produced some low priced quick selling calculators from which they made quick money and walked off. In a strict sense the demand saturation can be correctly described as demand stabilisation because the earlier demand boom was very artificial, being generated by very low prices (with inherent poor quality) which these 'casual' but nevertheless large manufacturers had been able to offer.

In India, of course, the market has just opened, and it will still take a very long time to get to the stage of saturation. In fact, currently we should just be approaching the boom period. No doubt, as in the international scene, there has been a mushroom of all sorts of manufacturers and traders becoming active in this field. The Indian market has certainly seen the price declines, but now a fair amount of stability is prevailing. With the present import duty structure and the high yen rate the prices are at their reasonable minimum and should remain at this level till the time certain key components are taken up for manufacture in the public sector.

A striking similarity in the Indian scene compared to the international phenomenon is obvious. A host of names in this field are houses out for quick business. They are either traders or manufacturers of other diverse items. Very few manufacturers are truly dedicated to this line by its technology. It can be expected that in due course only the dedicated manufacturers will stay in the field and the market will be still more stable. At the moment, if the customer gets a price advantage due to excessive competition, he should be extra cautious as this may be at the expense of quality. Ultimately we can expect a much more mature and stable market deliver quality goods.

In the international scene the LCD (Liquid Crystal Display) is becoming increasingly popular because of its advantages of low power consumption and smaller overall size of the calculator. Indian manufacturers and customers have to go with a certain amount of caution because: (a) LCD displays are still considered to be very sensitive to temperature and this factor is very important in our country, (b) battery cells for these machines are still not available (freely) in our country, (c) the cost of LCD machines is still higher than the other most popular display—green fluorescent, (d) LCD contacts are made with special conducting rubber materials which tend to create problems in vibration, humidity, and temperature variations. Unless most of these problems are carefully overcome, the fluorescent display will continue to take the major share in the Indian market.

A very important component of the calculator is the keyboard unit. Reliability of the calculator depends significantly on this component. While for desk calculators there are now fairly good manufacturers of keyboards, much has to be done by way of prices and range of product variations.

For pocket calculators there is still no good indigenous source for keyboards. Some manufacturers are making their own keyboards, but most of them still have to import.

DC-DC converters constitute another major part of both pocket and desk calculators. Till recently this part was being imported, but now a few reliable sources of this product have established themselves in this field and we are doing well both in terms of price and quality.

A very important and linked area in the calculator field consists of advanced calculators, microprocessor systems, and electronic cash registers. There are currently only a very limited number of manufacturers active in this field and the prices, therefore, tend to be higher. These items should be taken up by more manufacturers to have a complete range of products. This will give a better price performance to the customers and also in turn give the manufacturer and the industry its much desired stability. ☐

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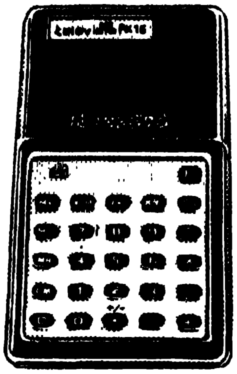
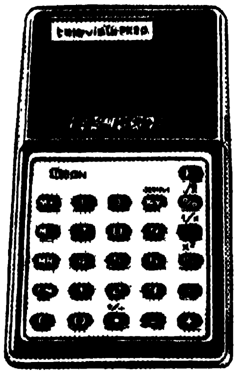
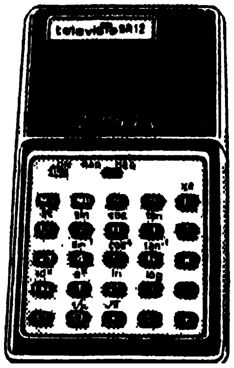


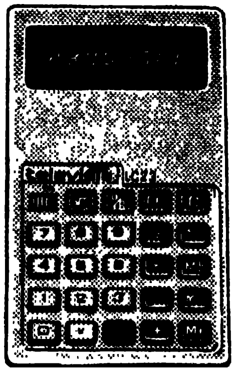
PK 16
A slim pocket calculator with four basic functions, percentage, square root and one independent memory with 5 key operation including exchange memory, useful for all general calculations 8 digit green display



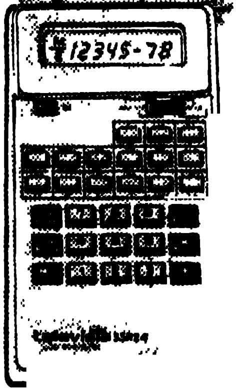
PK 20
Pocket calculator with four basic functions, percentage and basic slide-rule functions of square, square root, reciprocal and parenthesis. One independent 8 digit accumulative memory with X↔M.



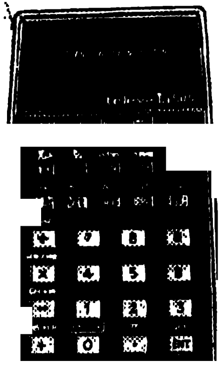
SR 12
Trigonometric, exponential and logarithmic functions, π entry and two level parenthesis Display is 8 digit with sign or 5 digit mantissa and 2 digit exponent with algebraic sign.



LC 23
An ultra-slim pocket calculator with memory, percentage and square root. 8 digit LCD display. Works on silver oxide batteries that last for more than 1400 hours.



SSR 24
The most sophisticated pocket slide-rule with LCD display. Having all trigonometric, statistical, exponential and logarithmic functions. Displays 8 digits with sign or 5 digit mantissa and 2 digit exponent with sign.



SR 5
All trigonometric, hyperbolic, exponential, logarithmic and statistical functions. Metric to British conversions. 4 keyboard memories and 9 more independent memories. Dynamic range of + 199 to - 200. Uses Reverse Polish Notation.

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Televista PK20, SM21 PD22 are available on DGS&D rate contract No. ME/5/RC-9607/EDC/Televista/III/ PAOD/725 dated 24.10.1977

NOW YOU CAN PLAY WITH YOUR POCKET CALCULATOR

Dr Samir Kumar Ghosh

I assume that you are in possession of a pocket calculator which you probably use for your arithmetical problems or for preparing the bills. But you will see how a great many more things can be done with this mini machine.

In fact, this tiny machine can be made to talk — provided one settles for words that contain the letters i, e, o, 1, h and s. For example, try with the number 107734; enter the digits and read by turning the calculator upside down!

Another way of having the machine show off its vocabulary is to think of the word you want displayed and then work up a problem that gives that word. During the oil crisis period, one asked his friend, "Where did you get oil for your car?" The friend andswered by multiplying 142.15469 by 5 and showing the results on a calculator upside down. Another time he answered by multiplying 284.02212 by 2.5 and showing the results upside down.

Before introducing some games with the calculator, two pre - assumptions are being made. The first is that the readers (or at least the persons they wish to impress with these games) are not mathematical wizards (the calculator is, of course). The second is that a medium - priced standard calculator with facilities of the four basic arithmetical operations, viz, addition, subtraction, multiplication and division, is available with the readers. With these assumptions the games follow:

First game

The calculator is well schooled in Indian history. The calculation 6760.4573 X 234 will cause the machine to give you an important date of Indian history. Try it. (No need to turn your calculator upside down this time.)

Second game

The calculator can tell the exact date and month of birth of your friend along with his age. Hand over your machine to your friend and ask him to record the number representing the month of his birth (January as 1, March 3, and so on) and to multiply it by 100. Ask him to add his date of birth, then to multiply the result by 2 and to add 9. He should again multiply by 5, add 8, multiply by 10, and subtract 422. Then ask him to add his age (in years). At this stage you may take back the machine from him and subtract 108. Now the calculator shows his date of birth — the first digit(s) gives the month of his birth, the next two the date (zero appears as the first of these 2 digits if the date is less than 10) and the last two digits give his age. A real fun, of course!

Third game

Ask anyone to count the value of coins (in paise) that may be lying in his pocket. If the total is less than a rupee, ask him to record the total in the calculator. Then request him to multiply by 10, and add 1, again to multiply by 2 and to add 21, and finally to multiply by 5. The result will always be a number ending with 15. The figure to its left is always one more than the actual total value of coins your friend had in his pocket.

Fourth game

Request someone to imagine a number (any up to six digits) and to record it in the machine. Ask him to multiply it by 2 and to add 4; then to multiply the result by 5 and to add 12; and finally to multiply by 10 and to subtract 320. The result is a number ending with one or more zeros. Drop them and the figure left over is the number your friend started with.

Fifth game

Announce that you can give the sum of all the odd numbers, from one up to and including whatever odd number someone in your audience chooses. Increase the selected odd number by 1, divide by 2 and square the result. You will have the desired total.

In case someone challenges that you can accomplish only in giving the sum of odd numbers, you can hoodwink him by giving the sum of all the numbers (odd and even). Ask him to choose any odd number. As before, increase the number by 1, divide by 2, square the result. Now double the answer and subtract the number that you had squared. You will have the sum of all the numbers from one to the odd number which your friend had chosen.

Sixth game

Now a game involving one's age and the coins lying in one's pocket. Ask someone to double his age and to record it in the machine. Then tell him to add 5 and multiply by 50. Now request him to add the amount of change (in paise) lying in his pocket (this must be less than a rupee). At this stage you may take the calculator from him and subtract the number of days (365) in a year, add 115 and divide by 100. The result obtained has two parts — one or two numbers to the left of the decimal point (one, if your friend is less than 10 years old) and two numbers on the right. The number on the left gives his age, and that on the right gives the total amount of coins lying in his pocket.

Lastly, a remarkable quirk number. It is 3025. Split it up into two parts — 30 and 25. Add them up and square the result. See what the mini wizard displays. ☐

Dr S.K. Ghosh teaches physics and biophysics in Visva Bharati University, Santiniketan.

KNOW-HOW FROM E.T.T.D.C. FOR DIGITAL MULTIMETERS

Three new models of low-cost digital multimeters based on complete LSI design and LED/LCD displays have been developed by CSIO, Chandigarh and the know-how is available for transfer to Industry. ETTDC would also assist in importing LSI and other critical components in bulk to achieve cost advantage. The salient features are:—

DC Voltage	*Model EC-1*	*Model EC-2*	*Model EC-3*
Ranges	±1.5V; ±15V; ±150V; ±1000V. (With passive) probe for 5KV)	±200mV; ±2V; ±200V; ±1000V.	±200mV; ±2V; ±20V; ±200V; ±1200V.
Accuracy	±0.5% of range ±1 digit.	±0.1% of range ±1 digit on 200mV and 2V ranges. ±0.2% of range ±1 digit on other ranges.	±0.01% of range ±1 digit on 200mV and 2V range. ±0.02% of range ±1 digit on other ranges
Resolution	1mV on 1.5V range.	100uV on 100mv range.	100uV at 200mv range
Input impedence	10M Ohm on 1.5V range; 1M Ohm on other ranges.	1000M Ohm on 200mV - 2V range. 10M Ohm on 20V - 1000V range.	1000M Ohm 200mV and 2V range 10M Ohm on other ranges.
Polarity	Automatic bipolar	Automatic bipolar	Automatic bipolar
Overload Protection	600V on basic range.	500V d.c. on basic range.	1200V on all ranges.
AC Voltage			
Range	1.5V; 15V; 150V; 1000V (maximum 600V r.m.s.)	200mV; 2V; 20V; 200V; 1000V.	200mV, 2V, 20V, 200V, 1000V. (600V r.m.s. maximum)
Accuracy	±1% of range ±1 digit from 50Hz to 2KHz	0.3% of range ±1digit from 50Hz - 10KHz. 0.5% of range ±1 digit from 10KHz - 20KHz.	0.05% of range ±1 digit from 100Hz - 10KHz. 0.1% of range ±1 digit from 50Hz - 100Hz, 10KHz - 20KHz.
Resolution	1mV on 1.5V range.	100uV on 100 mV range.	10uV on 200mV range.
Input Impedence	1M Ohm shunted by 20pf.	1M Ohm by 20Pf.	1M Ohm shunted by 20Pf.
Overload Protection	500V r.m.s. (Maximum)	500V r.m.s.	600V r.m.s.
Resistance			
Ranges	1.500K Ohm; 15K Ohm; 150K Ohm; 1500K Ohms.	2000 Ohms; 2K Ohms; 20K Ohms; 200K Ohms; 2000K Ohms.	200 Ohms; 2K Ohms; 20K Ohms; 200K Ohms; 2000K Ohms; 20M Ohms.
Accuracy	±0.5% of range ±1 digit.	0.2% of F.S. ±1 count.	0.02% of range ±1 digit for 200 Ohm −200K Ohms range. 0.05% of range ±1 digit for 2000K Ohm-20M Ohm range.
Resolution	1 ohm on 1.500K ohms range.	100m ohms on 200 ohms range.	10M ohm on 200 ohms range.
Current Through Unknow	1.500K; 15K; 150K; 1mA 100uA 10uA	2000 Ohms; 2Kohms; 1mA 1mA	—

	1uA	100uA	10uA
	(External shunts can be provided for measurement of current)	2000K Ohm 1uA	
D.C. Current			
Ranges	—	—	±200uA; ±2mA, ± 20mA; ±200mA; ±2000mA
Accuracy	—	—	0.05% of the range ±1 digit on first 4 ranges. 0.1% of the range ±1 digit on 2000mA range.
Resolution	—	—	10uA at 200uA range.
A.C. Current			
Ranges	—	—	200uA; 2mA; 20mA; 200mA; 2000mA.
Accuracy	—	—	All ranges 50Hz —10KHz (10 1% of range ±1.digit)
Resolution	—	—	10uA at 200mA range
General			
Display	3½ digit 7 segment LED display (LCI) option available	7 Segment LED 0.5 display	4½ LED 7 Segment display
Overload Indication	Flashing display for out of range indication	Flashing display for out of range indication	Flashing display for out of range indication
Power	Battery operated 6V (Eveready Cells) 1 5V x 4.	230V A C ±10% 50Hz 2 Watt.	230V A C.
	Battery operated 9V (Eveready dry cells) No. 2169V x 1.	—	—
Remarks	Analogous to AVO-meters, useful for servicing, etc	Laboratory model for digital design.	High precision model of 4½ digit

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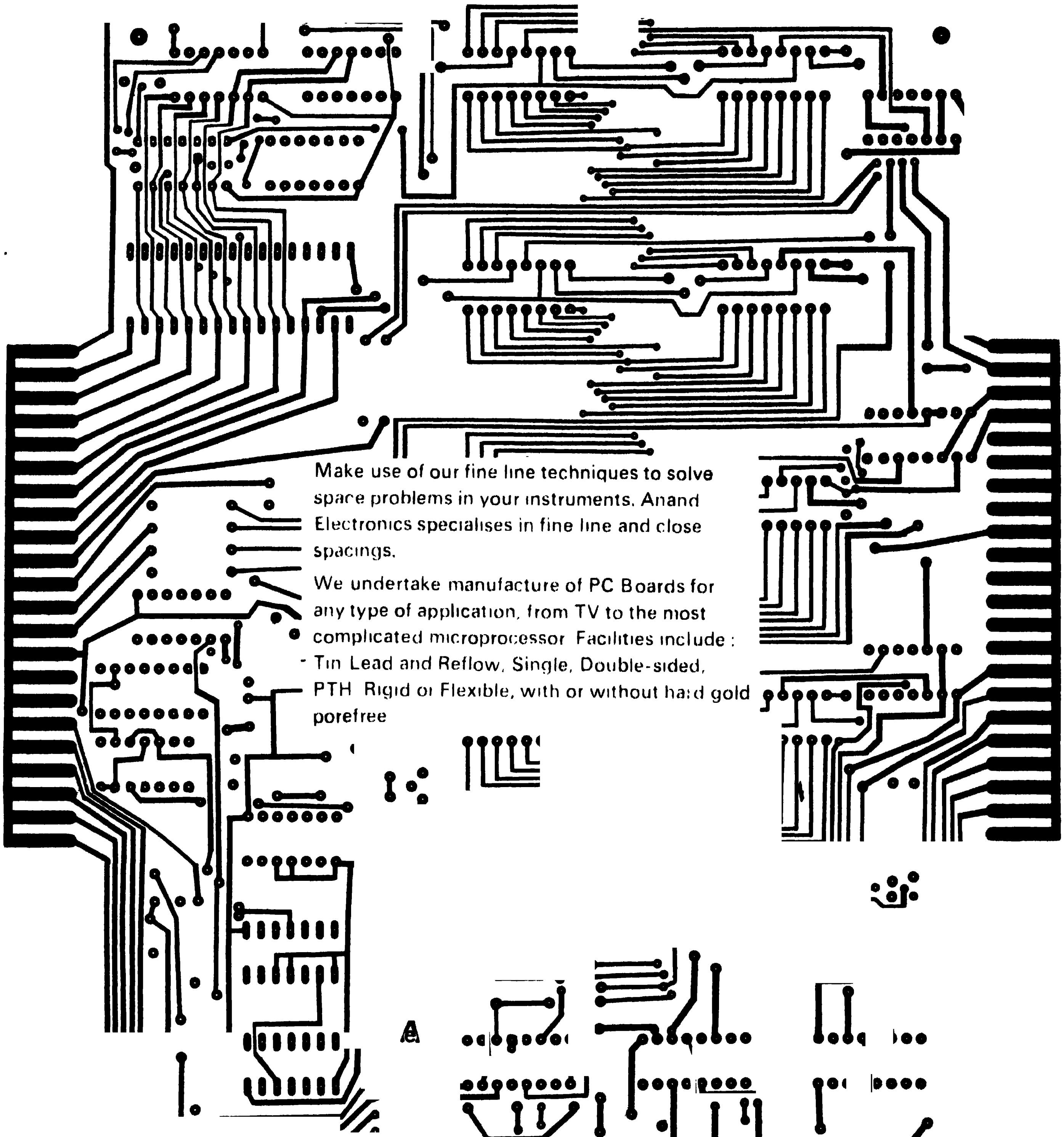

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SPECIAL SUPPLEMENT II

Advent of Electronic Calculators and Some Guidelines for Buyers

Veera A. Printer & Shakti Sagar, Microcomp Limited

When Wilhelm Schickard (in Germany) invented the first adding machine in 1623, and Pascal (in France) the first calculator with the 'carrying' facility in 1642, the abacus went out of mode. And since then mechanical engineering has never looked back. Its basic problem in fact is its slow pace as compared to the field of electronics. For centuries after 1623, the improvements in adding machines and calculators were based on mechanical devices, considered tedious and out-moded today. For example, the first calculator able to multiply was one manufactured by a German called Liebnitz, in 1671. It could multiply by doing rapid additions, and strangely enough, the very same logic continued till 1970 in India, and some such models are available even today.

However, the electronic calculator built around the integrated circuit chip (which was itself developed around 1960), has been gaining tremendous popularity and today there is scarcely anyone who is not familiar with, in some way or another, an electronic calculator. Since the development of the IC chip, the pace of electronics cannot be fast enough. Everyday, there are new breakthroughs, improvements and newer techniques.

More and more people today are discovering the need to save time and mental fatigue. What took a man one day to calculate manually can now be done on a calculator in 1/8th of the time, if not less, and moreover with cent per cent accuracy.

Calculators are specialised products that serve various segments of society. They are being used by students and younger children for whom calculations form an important part of their education itself. Business houses are using them to keep track of finances, pilots to plot courses, scientists to analyse experimental results, and engineers to complete designs. In fact even the American astronauts of the 1975 Apollo Soyuz space rendezvous used a calculator to back up their on-board computer system.

Electronic calculators have come a long way since they were introduced in 1971. Machines which were capable of only performing the four basic functions were sold at exhorbitant prices. In India, before the great price war began in 1976, a pocket calculator cost around Rs 900 (currently varying from Rs 250 to Rs 450) and the printer model Rs 9000 (currently varying from Rs 3000 to Rs 4000)! The heavy cut in profit margins due to the fall in prices are offset by a heavier demand for the product which is now within the reach of the common man. What was a low-volume and high-margin industry is now a high-volume but low-margin industry.

Guidelines for buying

In a span of just five years since the first calculator was assembled in India, the market has been flooded with manufacturers. There are over 30 units assembling calculators regularly and several smaller firms too. The price war will eventually narrow down this sphere to a few well-established companies. However, the technically ignorant purchaser faces a dilemma when he decides to purchase a calculator. There are too many to choose from. How does he know which one would serve him the best!

Here are a few guidelines to help him take a decision:

1. Reputation of the company manufacturing and selling the product.
2. Components availability, especially when (as in India) the major components, such as IC chips, display tubes and printing units, are imported.
3. Functional capabilities to suit the buyer's need.
4. Size.
5. Layout, structure, appearance, clarity of the keyboard, display, accessories etc.
6. Power and voltage suitability.
7. Service.
8. Durability.
9. Price. □

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EFY
Buyers' Guide to Electronic Calculators

Special features of some Indian calculators are being published in this guide, based on the information supplied by the manufacturers or their selling agents. Prices, wherever published, include excise duty, but do not include sales tax etc. This year, many of the manufacturers have refrained from indicating prices, because: (i) these are widely fluctuating, (ii) discounts are known to be given in various forms to institutions and bulk purchasers.

Prices, wherever mentioned, include excise duty and surcharge on excise, but not the local taxes and packaging & freight charges for outstation delivery. In some cases, prices of some ancillary items like carrying cases have been included.

Some of the manfacturers did not bother to participate in this supplement, in spite of our reminders. We are, nevertheless, giving their addresses so that those who wish may contact them directly for details regarding their products.

If there are any manufacturers who have been left out, inadvertently, they are requested to get in touch with us so that we can include them from next time.

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The 475 is a switch designed for long life applications in computer peripherals, data-entry terminals and business machines. It is human-engineered for operator convenience and comfort. Single pole and Double pole switching are standard with momentary or alternate action options.

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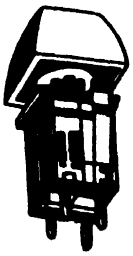
215

415


475

215 Series

A versatile and high-performance switch, the 215, can ideally be used in hand-held and small calculators.

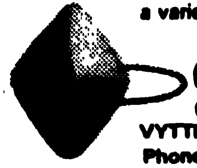
It has a single normally open contact rated for 100 mA at 5VDC. The more popular calculator characters are available double-shot moulded in various keyboard colour combinations

415 Series

The 415 is another OAK Switch introduced in India for desk calculator applications. With its low profile it lends itself to a variety of data entry applications.

Its single normally open contact is rated for 100 mA at 5VDC.

All calculator characters are available as standard hot-stamped on keytops with a variety of colours.



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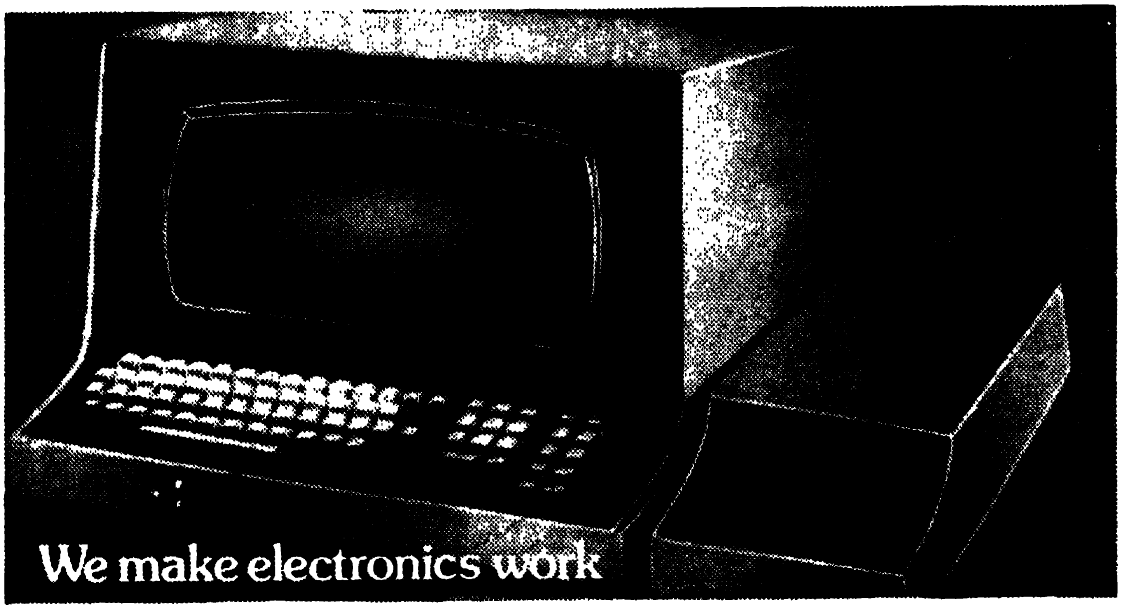

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EP-OEN-29

(a) Pocket/Hand - held calculators

ARISTO

Scholar: 12-digit green display; full - feature memory; 40 keys; exponentiation range $10^{\pm 99}$; scientific notation — 8-digit mantissa & 2-digit exponent; log, antilog and hyperbolic; trignometric and inverse functions; data reset; keys for pi, reciprocal, square and root; y^x; X ↔ Y

Student: 9-digit green display; store and recall memory; 36 keys; exponential range $10^{\pm 99}$; 5-digit mantissa & 2-digit exponent; trignometric, and inverse, log and antilog functions; 2 parenthesis levels; keys for pi, reciprocal, root, square, and a^x

Student II: 9-digit blue display; store and recall memory; 40 keys; dynamic range 10^{-7} to $10^8 - 1$; trignometric and inverse, log and antilog functions; data reset; degrees to DMS and inverse; keys for pi, reciprocal, square, root, percent, Y^X ; X ↔ Y; X ↔ M

Student III: 9-digit blue display; full feature memory; 40 keys; exponential range $10^{\pm 99}$; 5-digit mantissa & 2-digit exponent; trignometric and inverse, log and antilog functions; degrees to DMS and inverse; change notation; keys for pi, square, root, reciprocal, Y^X , X ↔ Y, X ↔ M

Engineer: 8--digit green display; full feature memory; 33 keys; floating decimal/ - sign; algebraic operation; linear metric conversion; parenthesis; keys for pi, percent, reciprocal, square, root, X ↔ Y, X ↔ M

800: 9-digit green display; basic slide rule; full feature memory; 30 keys; exponential range $10^{\pm 99}$; algebraic operation; add-on/discount; parenthesis; keys for reciprocal, square, root, X ↔ Y, X ↔ M

Executive LCD: general - purpose; 9 - digit LCD display; memory; 23 keys; floating decimal; overflow indication; algebraic operation; chain and mixed operation; auto constant; keys for pi, root, change sign, percent

Mini Executive: 9-digit green display; general - purpose; full feature memory; 24 keys; floating decimal; algebraic operation; chain and mixed calculations; constant; keys for root, percent, change sign

Executive: 9-digit general - purpose; full feature memory; 24 keys; chain calculations; keys for percent, root, X ↔ Y

Executive II: 8-digit LCD display; general-purpose with accumulating memory; 25 keys; ultra-thin (6.5 mm) and small; auto shut-off; two pcs silver oxide battery; algebraic operation; constant; clear entry; keys for reciprocal, root, percent, change sign

Economy LCD: 8-digit LCD display; slide rule with full feature memory; 28 keys; floating decimal; algebraic operation; auto error detection & display; indications for memory, negative, overflow, error; keys for pi, square, root, power, inverse, change sign

Banker: 9-digit display and memory; calculates interests, maturity periods and values, discounts, cash flow, depreciation, annuity etc

Statistician: 8-digit display; full feature memory; 32 keys; floating decimal; auto shut-off; percent and root; overflow and error indication; mean and standard davation; coeff. of correlation, slope and intercept; Y intercept

Mathematician: 8-digit LED display; accumulating memory; 32 keys; floating decimal; trignometric and inverse, log and antilog functions; degrees to radians and inverse; reverse Polish notation; M $+X^2$; M +X; M −X; Y^X, square; root; reciprocal; pi.

Programmable Scientist: 8-digit LED display; independent memory; 32 keys; 102-step storage; 4 registers; reverse Polish notation; exponential range $10^{\pm 99}$; 8-digit mantissa and 2-digit exponent; trignometric & log functions.

CALCOM

26: 8-digit green display; general - purpose with independent memory; 16 digit approximation; 24 keys; indication for negative, memory, overflow; add-on/discount; floating decimal; keys for percent, reciprocal, square, root, pi, change sign. *Price: Rs 280*

31: 12-digit slide rule model with memory; 37 keys; trignometric and inverse, log functions; double parenthesis; keys for root, reciprocal, pi, change sign, Y^X . *Price Rs 660*

35: 12-digit scientific programmable (102-step storage, 5 registers); accumulating memory; 42 keyboard functions; 10^{-99} to 10^{+100} range; 8-digit mantissa and 2-digit exponent with signs; floating point entry; 2-level parenthesis; input registers exchangeable; natural logic; auto constant; trignometric and inverse, log and antilog functions; polar to rectangular and reverse; degree to DMS and reverse; keys for change sign, pi, reciprocal, root, square, power (X^Y).
Price: Rs 2400.

45: Business programmable (102-step programming, 5 registers); 9-digit green display; 20 financial and statistical funtions; fixed/ floating decimal with auto underflow; 10^{-7} to 10^8-1 range; algebraic and business mode calculations; auto constant; change sign; percent with add-on/discount; commission; average; sum of squares; sale/cost/ margin; trend and forecasting; present and future values; interest; payment; exponentiation. *Price Rs 2200.*

CANDID

80/80D/Readycall III: 8 digit green display; independent memory; percent; pi; reciprocal; squares; roots; sigma; change sign; auto constant; repeat and chain calculations; sleeping display.*Price Rs 290.*

DIGICAL

8 MS: 8-digit green display; independent memory; add-on/discount; parenthesis; keys for root, reciprocal, square, change sign, X ↔ Y, X ↔ M

8 MP: 8-digit green display; independent memory; keys for profit and loss, root, pi, change sign, exchange; decimal set point option.
8 S: 8-digit green display; memory; double parenthesis; trignometric, inverse, log and antilog; degree/ radiant operation; keys for reciprocal, root, square, pi, change sign, X^y
8 LPS: 8-digit LCD display; independent memory; percent and add - on/discount; works on two pcs of silver oxide cells.
8 LS: 8-digit LCD display; one memory; two levels of parenthesis; trignometric and inverse, log and antilog functions; degrees to DMS and vice versa; exchange and exchange with memory; square, root, reciprocal, pi, Y^x keys; statistical functional keys; operates on three pcs of silver oxide cells.
8 LP: 8-digit LCD display; independent memory; percent and add-on/discount; root, square, reciprocal, pi, X^n keys; works on two pcs of silver oxide cells.
8 SS: 10-digit green display; 5 independent memories; double parenthesis; trignometric and inverse, hyperbolic and inverse, logs (incl. Ln) and antilogs; degree/radian, polar/rectangular, DMS; statistical functions; reciprocal, root, square, X^y, pi, exchange keys.

ELMER

Mini 8-S: 8-digit display; independent dynamic memory (M+, M -,RM & CM); percent & add - on/discount; auto constant in 5 functions; keys for root, square, reciprocal, change sign and pi. *Price Rs 230.*
Mini SR-8: 8-digit engineering model; fully operative memory; auto constant in 5 functions; trignometric and inverse, log and antilog (common and natural) functions; double parenthesis; root, square, reciprocal, change sign and power keys. *Price Rs 330.*

KELTRON

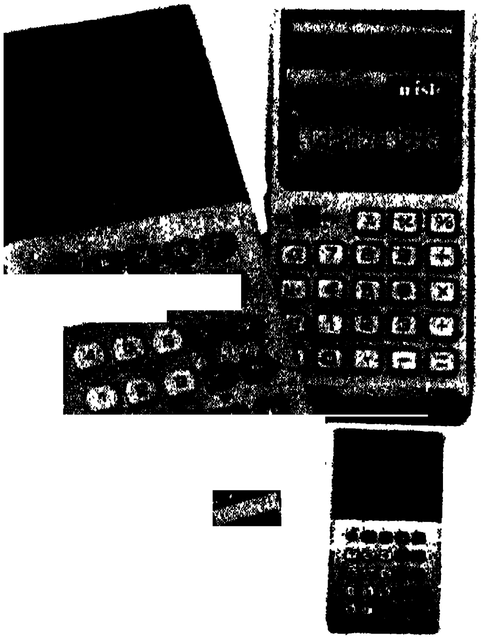
5408: 8-digit display; memory (M+,M -, RM, CM); constant; floating decimal; keys for percent, pi, root, square, reciprocal, change sign and CE.
5308: Same as 5408, except it does not have square, reciprocal and pi keys. But it has sigma facility.
5608: 8-digit display; memory; trignometric & inverse, Ln, e^x, log 10^x functions; keys for X^y, reciprocal, root, square, pi.
5808: LCD display. Same as 5408, except repeat calculation; but has X^n facility.
2108: 8-digit financial calculator; 5 registers; present and future value, payment per period, interest calculations; trend, cost, margin, price calculations; average and standard deviations; square - root; discounted cash flow analysis.

LOGICAL

Minimarvel: 9-digit green display; 4-key independent dynamic memory; auto constant (5 functions); percent with add - on/discount; root; clear entry; full floating decimal; indications for negative, error/ overflow, memory in use.
8M: 9-digit green display; dynamic memory (protected during overflow); floating decimal; root, square, reciprocal, pi, change sign functions; percent with add - on/discount; indication for memory and error/ overflow.

MECOM

PRO: 9-digit green display scientific calculator; full floating decimal; 5-digit mantissa with – sign and M indication plus 2-digit exponent with – sign; chain and mixed calculations; trignometric and inverse, log and antilog functions; constant; power; reciprocal; root; pi; conversion of minutes and seconds into degrees. *Price: Rs 470.*



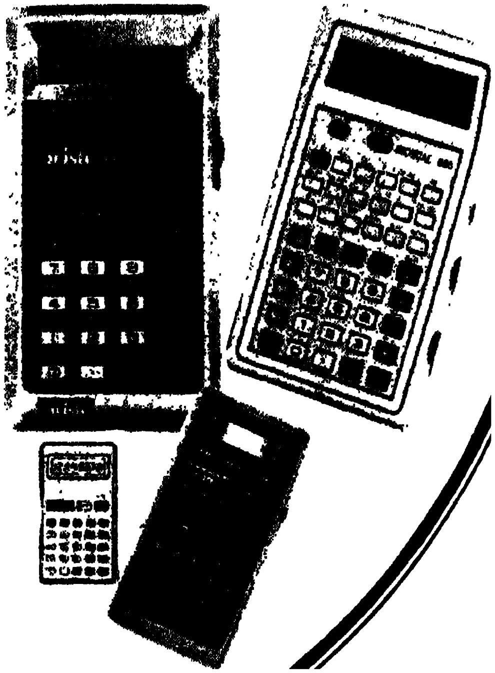
LC: 8-digit LCD display; full memory; sleek shape; 24 keys; full floating decimal; percent with add - on/discount; root; clear entry; change sign. *Price Rs 445.*

MOSCAL

8 ESR: 8-digit slide - rule calculator; full memory; 5-digit mantissa & 2-digit exponent; green display; two - level brackets; trignometric, Ln, log and their inverses; reciprocal, root, square, pi, exchange, change sign, X^y capability; floating pointer exponent mode — selectable degree or radian mode.
885: Scientific model; 8-digit mantissa & 2-digit exponent (green); 5 independent memories; selectable floating or fixed decimal; degree/radian/ gradian mode; 2 level brackets; trignometric, Ln, log, hyperbolic & their inverses; reciprocal, root, square, exchange, change sign, pi, Y^x capability; mean and standard deviations; factorials; polar to rectangular and vice versa.

MULTIPLEX

PK 78: 8-digit green display; memory; floating decimal; keys for percent (add - on/discount), root and CE/C; indica-



tions for memory 'on', overflow and credit balance; constant. *Price: Rs 265.*

ORION

Rising: 8-digit green display; memory; algebraic operation; auto constant; floating decimal; keys for percent, root, pi, change sign, CE/C; 9th digit for sign. *Price: Rs 175.*

OMRON

01 B: 9-digit green display; no memory; floating decimal with truncation; percent with add - on/discount; square - root and CE keys.

02 B: 9-digit green display; 4-key memory; parenthesis; percent with add - on/discount; keys for root, square, reciprocal, pi, change sign, C/CE; algebraic mode.

03: 9-digit green display; memory; 5-digit mantissa & 2-digit exponent with signs; floating decimal with truncation; trignometric and inverse, log and antilog, exponential functions; double parenthesis ; direct reciprocal, root, square, X^y , pi, change sign; degree/ radian selection.

SR 5: 12-digit slide-rule; 9 memories and 4 registers; reverse Polish notation; over 40 functions for scientists, engineers, statisticians and architects.

707: 9-digit LCD display; memory; auto constant; percent with add - on/discount; square - root and memory calculations; change sign and CE.

QUICAL:

Mini 8M: 8-digit green display; independent memory (M+, M -, MRC); floating decimal; auto constant for multiplication/ division; percent with add - on/discount; keys for root, change sign, pi, CE/C; overflow; memory and negative indications. *Price Rs 183.75.*

ESR - 1: 8-digit slide - rule model; independent memory (M+, M -, CM, RM); 5-digit mantissa and 2-digit exponent; floating decimal; memory exchange; trignometric and inverse, log and antilog functions; degree/radian mode; auto change - over to scientific modes for results outside normal modes; overflow, memory and negative indications; direct root, reciprocal, pi; change sign; indicator (F) for functional mode. *Price: Rs 450.*

TELEVISTA

PK16: 8-digit green display; independent memory with 5-key operation; keys for root, percent, exchange, exchange memory. *Price: Rs 274.59.*

PK 20: 8-digit green display; full independent memory; exchange of registers; percent with add - on/discount; exchange of memory with display; root, square, reciprocal, parenthesis; memory and overflow indications.
Price: Rs 327.29.

SR 12: 8-digit green display with sign; slide-rule model; 5-digit mantissa & 2-digit exponent with signs; floating decimal; independent memory; overflow indication; reciprocal, root, square, change sign, double parenthesis; trignometric & inverse, log & antilog; degrees/radians. *Price Rs 593.37*

LC 23: 8-digit LCD display; floating decimal; independent memory with 5-key operation; percent with add-on/ discount; change sign; root; memory & overflow indications. *Price: Rs 513.*

SSR 24: 8-digit LCD scientific; independent accumulated memory; 5-digit mantissa & 2-digit exponent with sign; auto repeat and constant; trignometric and inverse, exponential, log and statistical; degrees/radians/ gradians with DMS key. *Price: Rs 927.38.*

SR 5: 12-digit slide-rule; all trignometric, hyperbolic, exponential, log and statistical functions; metric and British conversion; 4 keyboard and 9 independent memories; dynamic range of +199 to −200; reverse Polish notation. *Price: Rs 2770.*

UMS

101: 8-digit green display; memory; floating & fixed (2,4) decimal; direct reciprocal, root, square, percent; auto constant; indications for memory, overflow; exchange of registers. *Price: Rs 305.07.*

707: 9-digit LCD display; memory; algebraic mode; floating and fixed (2,4) decimal; percent add-on/ discount; direct reciprocal, root, square, pi, change sign. *Price: Rs 453.97.*

201: 9-digit green display; slide-rule model; accumulating memory; 5-digit mantissa with sign and 2-digit exponent, floating decimal; memory & overflow indications; trignometric and inverse, log and antilog functions; direct root, reciprocal, pi; keys for memory/display register exchange; degrees/ radians selection.
Price: Rs 312.86.

Colt: 8-digit green display, memory; auto constant; percent, root, CE/C keys; memory; auto constant; percent, root, CE/C keys; memory, overflow, negative indications. *Price: Rs 214.19.*

ESR 222: 9-digit green display slide-rule; double parenthesis; 5-digit mantissa & 2-digit exponent; radians/ degrees selector; algebraic operation; auto constant; trignometric & inverse, log and antilog functions; direct root, square, reciprocal, pi, sign change. *Price: Rs 386.01.*

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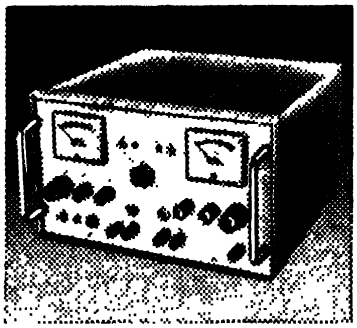

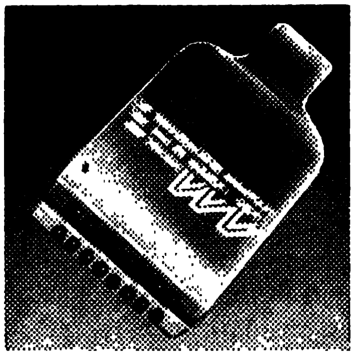

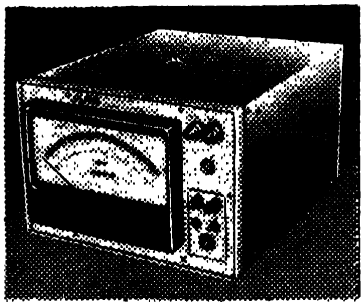

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WESTON

Minimate: 8-digit green display; independent memory; floating decimal; percent with add-on/discount; direct root, pi, change sign; clear entry; constant operation; memory, minus, overflow indications.
Price: Rs 260.44.

Scholar: 8-digit green display; independent memory; floating decimal; percent with add - on/ discount; direct square, root, reciprocal, pi, change sign; auto constant; memory, negative, overflow indications. *Price: Rs 347.25.*

Minimate LCD: 8-digit LCD display; independent memory; floating decimal; auto constant; percent with add - on/ discount; root; change sign; memory, minus and overflow indications; works on 3 mecury oxide cells. *Price: Rs 549.81.*

*Newton**: 9-digit scientific model; green display; floating decimal; algebraic operation; memory with store and recall keys; trignometric and inverse, log and antilog, exponential functions; direct reciprocal, root, square, pi; radians/ degrees selection; double parenthesis; C/CE, exponent X^y keys; error and negative busy indications. *Price: Rs 473.63.*

(b) Desk Calculators

ARISTO

Desk Model: 12-digit model with memory; auto power clear; floating and fixed (0,2,4) decimal; 5/4 round off; direct percent & root; constant switch; leading zero suppression; cooling system for continuous operation.

CALCOM

980*: 12-digit statistical cum scientific; 10 memories; 4 levels of parenthesis. *Price Rs 4000.*

980: 12-digit scientific cum statistical programmable model with 72 steps of programming; 4 parenthesis levels; trignometric, hyperbolic, log and inverse functions; 10 user addressable memories. *Price Rs 6000.*

CANDID

Desk Model: 12-digit green/blue display; fully independent 6-key memory; floating/ fixed decimal selector; percent; change; exchange; sigma; constant switch and chain calculations. *Price Rs 900.*

DIGICAL

1204 N: 12-digit with memory (M + M − , SM, TM); percent ; exchange of registers or reciprocal operations; negative sign and algebraic entry; clear entry and clear display facility; grand totalling and sub-totalling; floating decimal.

1214 M: 12-digit with memory (M + M − , SM, TM); percent with add-on/ discount; keys for root, reciprocal, exchange; constant, 5/4, decimal set point; single/ double item count option

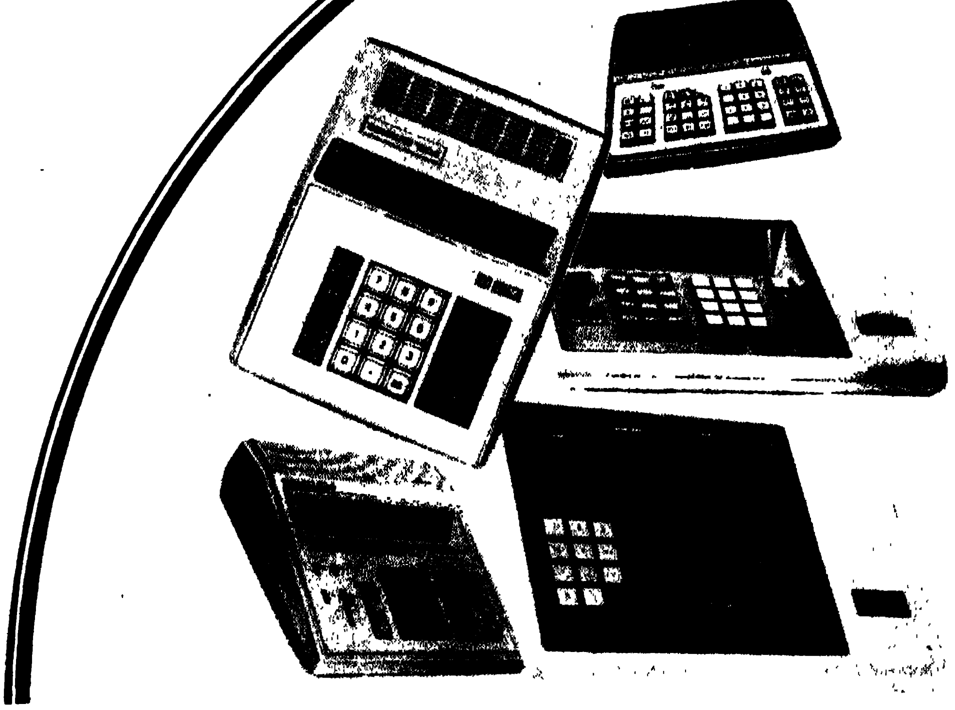
10 SJ: 12-digit scientific; 10 independent memories; 5 independent parenthesis; trignometric and inverse, log and antilog, exponentiation, exchange, convenience functions.

10 S: 12-digit scientific; trignometric and inverse functions; log and antilog; exponentiation and combinational functions; gamma and normal distribution functions; group operations and group controls; convenience and exchange functions.

10 SPR: 12-digit green display; 10 memories; 7 function memory; 72 steps; four levels of parenthesis; trignometric and inverse; hyperbolic and inverse; statistical; spherical/ cartisian conversion; editing (insert, delete. backstep, no operation); addressing (direct, indirect)

EC CAL

EC 25: 12-digit display; 2 independent memories; direct root and percent with add-on/ discount; decimal point selection for 0 to 8 places; auto constant for multiplication and division; repeat additions and subtractions; item count;



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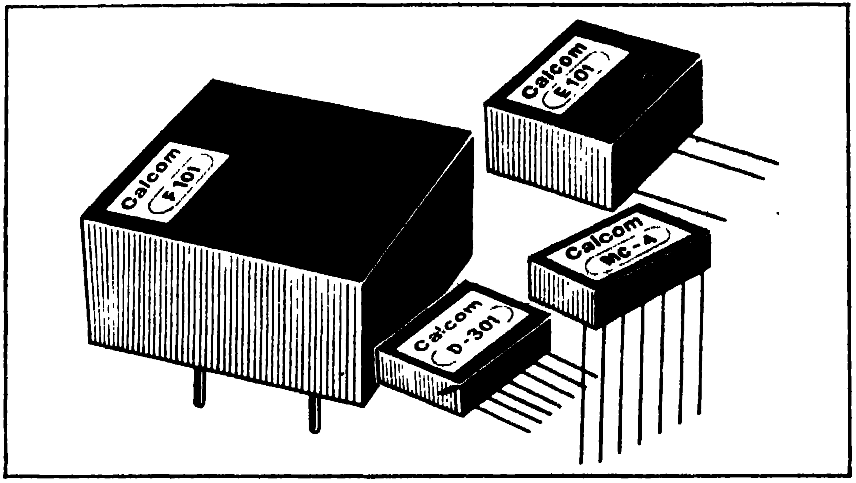

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SELECTION GUIDE

Type No.	Input (Volts)	Output (Volts) V1	V2	V3	V4	Power (Watts)	Eff. (%)	Case	Application
A 301	−2.4 to−4	−15	−25	3.0VRMS		0.25	70		Pocket Calculators
B 301	−3.5 to−6	−15	−25	3.5VRMS	—	0.275	70	B	
C 401	4 to 8	−15	−25	3.2VRMS	−7.5	0.375	70	C	
C 402	−4 to−8	−15	−25	3 5VRMS	—	0.175	65		
D 301	−2.4 to−4	−7.5	−25	2.5VRMS	—	0.175	65		
E 301	−6 to−12	−15	−30	5.5VRMS	—	0.8	75	E	Desk Calculators
E 201	5 to 12	15	−15		—	0.8	70	E	Instruments, Digital/Linear systems.
E 202	−5 to−12	15	−15		—	0.8	70	E	〃
E 101	−5 to−12	−175	—	—	—	0.8	65	E	Gas discharge displays, Instruments
F 101	10 to 30	5	—	—	—	5	65	F	Digital systems; sub systems, Lab. Instruments, Power supplies

Case Dimensions in mm : A: 29x14 5x7; B: 26x19x7; C: 33.5x27x8;
D: 25x17 5x10.5; E: 33.5x27x15; F: 52x52x25

Note : For full specification, request detailed data-sheets.

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auto accumulation; true credit balance; change sign; registers exchange; memory and error indication; round-off. *Price: Rs 1300.*

EC 61: Scientific model; 10-digit mantissa & 2-digit exponent with signs; floating point/ scientific notation entry; double parenthesis; memory register for storage of constant or intermediate results; indications for overflow, underflow and forbidden operations; trignometric functions using degrees/ radians; direct root, square, pi, Y^x, reciprocal; exchange of memory and working registers; clear entry; log and antilog functions. *Price: Rs 2800.*

EC 62P: Scientific programmable model; 8-digit mantissa and 2-digit exponent; 72-step programmable facility; 5 nested parenthesis levels; number entry in floating/ scientific notation; 0 to 7 places decimal selection; 10 memory registers for data storage; auto indications for overflow and forbidden operations; trignometric functions using degree/ radin entry; inverse trignometric, log and antilog, exponentiation and convenience functions; debug, unconditional and conditional branching programmable controls. *Price: Rs 3200.*

EC 65: Advanced scientific model; 10-digit mantissa and 2-digit exponent with signs; 2 nested parenthesis levels; 3 user-addressable memories (sum, sum-of- squares, index); number entry in floating point or scientific notation; trignometric and inverse, log and antilog, exponentiation and convenience functions; combinatorial and normal distribution functions; gamma function; group operations and group control; degree/ radian selection; clear operations; auto error detection and display. *Price: Rs 4600.*

ELCALTRON

Desk Model: 10-digit greenish-blue display; direct reciprocal, percent, square-root; arithmetic operation; floating or preset (up to 9 positions) decimal; auto constant; CE key.

KELTRON

1714: 14-digit display; memory with M$\underline{\pm}$, M$\underline{\mp}$; commas for 3-digit groups; underflow; exchange; floating or fixed (0 to 8) decimal; trunk or auto round-off; memory overflow and negative sign indications; percent; square-root; item count.

1814: 14-digit display; 2 independent memories; 3 selectable sigma modes for statistical calculations; register exchange; auto constant; commas for 3-digit groups; truncate or auto round-off; percent with add-on/ discount; root; item count; memory, overflow and negative indications

2712: 12-digit display; 6-key memory; 0 to 7 position decimal; truncate/ round-off; percent with add-on/ discount; keys for EX, root, CE; memory, overflow and negative indications

2510: Scientific calculator, two level parenthesis; 10-digit mantissa & 2-digit exponent; trignometric and inverse, log and antilog, permutation and combination, normal and gamma functions; average, standard deviation, square-root of some of squares, factorial functions; parenthesis, direct Y^x, reciprocal, root, square, 10^x, degree/ radian modes.

MASTER

Master II: 12-digit green display; 12-digit memory; fixed and floating (F, 0 to 6) decimals; percent with add-on/ discount; auto totalling, leading zero suppression, overflow indication

MOSCAL

1201: 12-digit green display; full 4-key memory with auto accumulation; decimal selectable at 0 to 8 and floated or list mode; 3-digit item counter; percent with add-on/ discount; keys for root, change sign, exchange; constant multiply and divide.

1204: 12-digit green display; 2 full 4-key memories with options of auto accumulation, constant percent accumulation, total accumulation, product of multiplication and number of items; decimal selectable at 0 to 8 and floating of list mode; percent with add-on/ discount; direct root, exchange, change sign; 3-digit item counter.

1032 S: Scientific model; 8-digit mantissa & 2-digit exponent (green display); full memory; 2 level brackets; trignometric and inverse, log and antilog functions; polar to rectangular; exchange; change sign; reciprocal; root; square; pi; degree/ radian/ gradian mode.

1402: Statistical model; 14-digit green display; 3 full 4-key memories; direct, percent, reciprocal, root; exchange; mean and standard deviations for single and grouped data; decimal selectable at 0, 2, 3, 4, floating or list mode.

Compute 1004: Simple 12-digit model; green display, full memory; percent with add-on/ discount; keys for root, change sign; 3-digit item counter.

MULTIPLEX

123: 12-digit green display; independent memory; keys for percent, exchange, CE, CN and 5/4; overflow, negative, memory indications; leading 0 suppression. *Price Rs 1150.*

OMRON

05: 12-digit green display; independent memory with auto accumulation; floating and fixed decimal; keys for percent, root, change sign , exchange, clear entry; rupee mode.

QUICAL

1200: Simple 12-digit model; direct percent and root; exchange and constant. *Price: Rs 810.*

12 M1A: 12-digit model with memory; direct percent and root; exchange and constant. *Price: Rs 865.*

8 M1A: 8-digit model with memory; direct percent and root; change sign; constant. *Price: Rs 800.*

14 M2A: 14-digit model with 2 memories; direct percent and root; ex-

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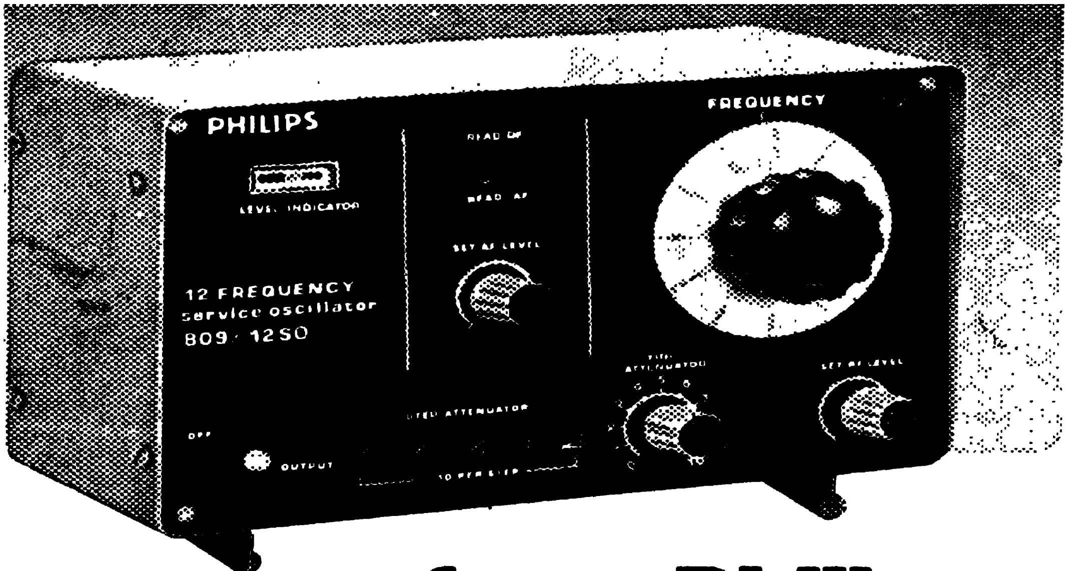

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Quick, easy operation
The definite calibration of this instrument enables easier and faster operation besides eliminating human errors during setting and reading.

High accuracy, minimum radiation
Since 12 frequently used spot frequencies are incorporated in this instrument, the output can be easily obtained with minimum errors. Comparative gain and sensitivity measurements in broadcast receivers are possible with this instrument.

Economy
It can give a performance similar to a professional signal generator, yet it is priced just as much as conventional service instruments.

Ideal for:

a) Comparative receiver measurements such as stage gains.
b) Alignment of RF & IF stages.
c) Fault-finding by signal analysis method.

Technical Data

Frequencies:	KHz	MHz		
	452	1.5	5	11.8
	455	3.15	7.2	15
	560	4	9.6	21.5

Output (RF):
35 mV RMS max. modulated at 30% with 400 Hz (on every frequency); can be attenuated in steps of 10 and continuously.

Modulation Frequency:
400 Hz

Supply Voltage:
240V 50 Hz AC.

Dimensions:
Length 223 mm.
Breadth 115 mm.
Height 150 mm.
Weight
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PR 72 SC: Scientific model with 8-digit mantissa & 2-digit exponent; 10 independent memories; 72-step programming; 5 levels of parenthesis registers; trignometric and inverse, common log and natural log functions; direct root, square, reciprocal, pi, change sign; register exchange; fixed (0 to 7) decimal; degree/radian options; error/ negative/ inverse indicators; Y^X. *Price: Rs 4630.*

PR 102 ST: 8-digit programmable statistical; 102 steps programming; accumulating memory; direct percent with add-on/ discount; auto constant; direct root; leading zero suppression; direct statistical calculations like mean, standard deviations, slope, intercept and coeff and correlation. *Price Rs 4630.*

PR 102 FC: 8-digit programmable financial model; direct percent with add-on/ discount; auto constant; accumulating memory; 102-step programming; direct depreciation/ appreciation, interest compounding, present and future value, amortisation, cash flow analysis and sinking fund. *Price: Rs 4630.*

SC 1: Scientific model; same as PR 72 SC except programming. *Price: Rs 4050.*

ST 1: Scientific model, same as PR 102 ST, except programming. *Price: Rs 4050.*

FC 1: Scientific model; same as PR 102 FC, except programming. *Price: Rs 4050.*

8 M 1 SC: 8-digit green display; memory; algebraic entry; trignometric and inverse, log and antilog functions; direct root, square, reciprocal, pi; floating decimal; 5-digit mantissa and 2-digit exponent. *Price: Rs 1040.*

REMINGTON

1204: 12-digit display; independent memory with auto operation; percent with add-on /discount; auto constant; round-off; fixed decimal selectable up to 8th place; square-root; clear entry; change sign; exchange; overflow and memory overflow indications; dynamic decimal point selector. *Price. Rs 1725.*

SIMPLE

008: 8-digit model with percent; floating decimal entry; floating or selectable (2, 4) decimal output with auto round-off; auto underflow of result; overflow/ negative indication; clear entry.

008M: Has all features of 008, plus an independent memory.

012 M: 12-digit model with independent memory; keys for percent, square root, exchange, M − and M +; floating or fixed decimal output with auto round-off; auto underflow; item count; memory and overflow indications.

012: Has all features of 012M, except the memory.

112M: Has all the features of 012M plus 2 memories and some other features.

TELEVISTA

SM 3 *: 12-digit green display; independent 12-digit dynamic accumulated memory; floating or selectable (0 to 9) decimal; percent with add-on/ discount; square-root; reciprocal; change sign; clear entry; indicators for memory, negative, overflow/ error. *Price: Rs 1238.60.*

SM 21: 12-digit display; independent 12-digit dynamic accumulated memory; percent with add - on/ discount; square - root; exchange of registers; 00 and clear entry; indicators for memory loading, negative, overflow/ error; floating/ fixed selectable decimal. *Price: Rs 1126.*

SR 6: Scientific model with more than 40 functions; 9 memories and 4 registers; reverse Polish notation; all trignometric, hyperbolic, exponential, logarithmic and statistical functions; metric to British conversions; dynamic range of + 199 to -200; scientific notation display 10 + 2. *Price: Rs 4551.25*

PS 7: Programmable scientific model with 72 programme steps and 10 memories; almost every essential mathematical function available direct; 5-level parenthesis; degrees to radians conversion; 8-digit mantissa & 2-digit exponent with signs: 10^{+99} to 10^{-99} range; full and fixed (0 to 7) decimal output. *Price: Rs 4278.80.*

U M S

CM 18K: 8-digit basic model; constant facility; leading zero suppression; floating or fixed (2, 4) decimal; overflow, underflow and negative signs. *Price: Rs 549.81.*

CM 110K: 10-digit red display; floating and pre-fixed (2, 4) decimal; overflow and negative signs; constant calculation and round-off. *Price: Rs 665.56.*

1122A: 12-digit amber display; memory; floating and pre-fixed (2, 4) and rupees mode decimal selection; memory, overflow and negative indications; percent; repeat additions and subtractions; constant multiplications and divisions; exchange. *Price: Rs 995.*

PROM: 8-digit for financial, mathematical and statistical calculations; LED display; 36 keys; suitable for arithmetical calculations, present and future values, loan payments, amortisation, annuities etc.

WESTON

Matrix: 12-digit display; percent with add-on/ discount; floating decimal input; floating and fixed (F, 0 to 6) decimal output; constant operations; 5/4 cut switch; exchange, recall facility; negative and overflow indications. *Price: Rs 1070.68.*

(c) Printing

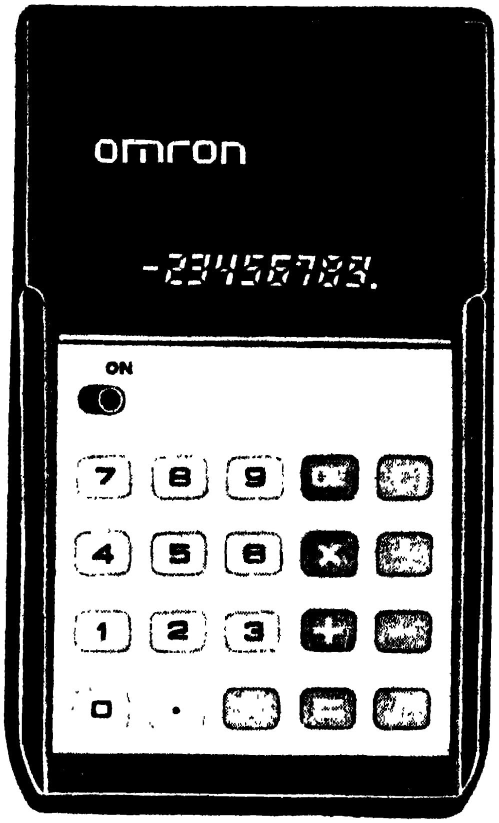
ARISTO

Printer Model: 12-digit display cum printing facility; memory; direct percent and root

CALCOM

2101 *: 12-digit printer cum display calculator; 2 memories; double item

Trust omron



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MICROCOMP

counter: direct root and percent; input buffer registers and roll over for high speed operations; double item counter; repeat additions and subtractions; constant multiplications and divisions; auto grand total; negative numbers in red. *Price Rs 3200.*

DIGICAL

12 PD: 12-digit printer cum display; 2 memories; 4-key memory; direct root, percent, EX (%-, n,000 option); right shift key; non-print, constant, 5/4; decimal set point (n +/n - option); add mode.

12 PDB: 12-digit printer cum display; 4-key independent memory; percent with add-on/discount; double item count; decimal selector/ add mode; 3 accumulator.

12 PPD: 12-digit programmable (14-step) printer cum display; 2 memories; date setting, average, tax, mark up; 4-key memory; direct root, percent, EX (%-, n,000 option); right shift key; double item count; non-print, constant 5/4, decimal set point (n -/n + option); add mode.

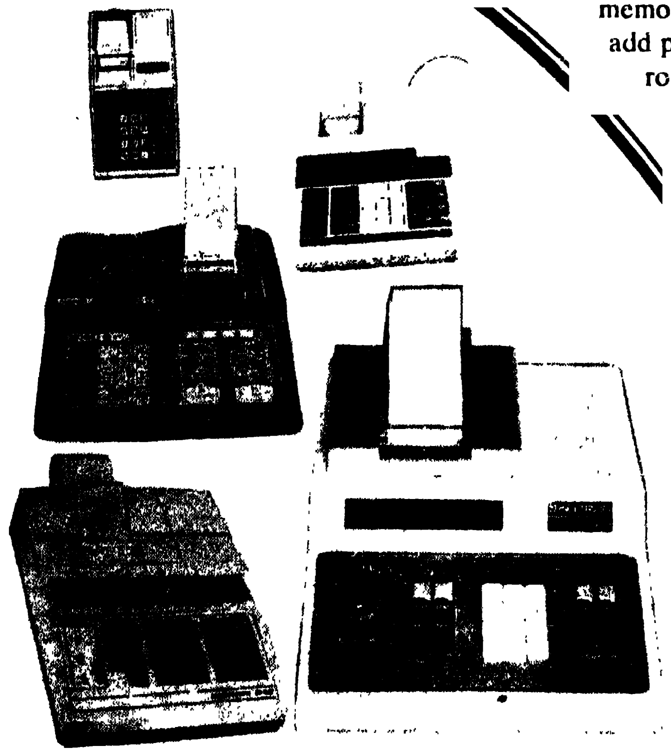
EC CAL

EC 31: Printer model (without display) for 12-digit calculations; independent memory; total and sub-total facility; item counter; auto accumulation; auto constant for multiplication and division; repeat addition and subtraction; decimal point selection from 0 to 7 places: true debit balance; change sign; exchange of registers; red print for negative numbers; error and memory indications. *Price: Rs 2500.*

KELTRON

2312: 12-digit display cum printer; 4-key memory; keys for percent, T, ST, CE and PF; decimal selection from 0 to 9; item count; non-print mode; commas for spacing 3-digit groups; auto underflow; auto round-off; memory, overflow, negative indications.

2412: 2 independent memories; non-add printing mode; round-off mode; date printing; repeat addition/ subtraction; chain, mixed and constant operations; percent with add-on/ discount; power and reciprocal; totalling and grand totalling; item count; memory, negative and overflow indications.



2912: independent memory plus grand totalling facility; percent with add-on/ discount; T, GT, CE, sub-total, item count, 00, memory keys; keyboard buffer for fast operations; round-off and non-add printing modes; date printing; repeat addition/ subtraction; chain, mixed and constant calculations; power and reciprocal calculations; memory, negative and overflow indications.

MASTER

Masterprint D12: 12-digit green display cum printer; single memory with own axis; chain and percent calculations; add mode switch, 5/4 round-off; underflow and overflow indications; print/ non-print button; floating and fixed decimal up to 6 places; negative entry printed in red; 3-digit item count; keys for 00 and 000.

MECOM

1212 PD: 12-digit green display and printer; fully addressable memory; percent with add-on/ discount; item count; exchange register; auto constant; repeat add/ subtract; non-add key; negative results printed in red; direct square - root and 00 entry. *Price: Rs 2900.*

MOSCAL

1217 P: 12-digit green display with printer; full, flexible 6-key memory; decimal selectable at 0, 2, 4, floating or list mode; number punctuation; 3-digit item counter; left hand printing for item counter and non-add printing; negative results printed in red; percent with add-on/ discount; direct root, EX, change sign; constant multiplication and division; chain calculations and repeat functions; sub-totalling and grand totalling.

MULTIPLEX

5154: 12-digit with memory; non-add print; item counter; grand total and sub-total; round-off; percent with add-on/ discount; root, square, EX keys. *Price: Rs 2650.*

OMRON

06: 12-digit green display cum printer; 12-digit dynamic accumulative memory with 4 keys; decimal selectable at 0, 2, 4, floating and add-mode; independent 2-digit and 3-digit item counters; direct root, change sign and clear entry; percent with add-on/discount; constant multiplication/ division; repeat addition/subtraction; exchange of registers; non-add key with sub-totalling; 00 and 000 keys.

QUICAL

PD 12: 12-digit green display and printer; floating decimal entry with selectable output 0, 2 to 6; add mode; percent with add-on/ discount; repeat addition/ subtraction; red print for negative results; independent 12-digit dynamic accumulated memory, item counter; non-add key with sub-total; 00 entry; memory negative and overflow indications. *Price: Rs 2215.*

PD 12A: 12-digit printer cum green display; sub-total, group total and grand total; 2 item counters; non-print mode; non-add key; red print for negative results; round-off/ truncation with 5/4 switch; punctuation/ spacing by 3-digit group; floating, fixed (0, 2, 4, 6) and add/ monetry mode decimal; 00 and 000 keys; independent accumulating memory with 4 keys; overflow, memory and negative indications. *Price: Rs 2430.*

TELEVISTA

PT 8 *: 12-digit printer; without display; 12-digit dynamic accumulated memory with 5 keys; direct 00 and 000 entries; item count with total; add/ list mode for 2 decimals. *Price:Rs 2527.20.*

PD 22: 12-digit green display and printer; independent 12-digit accumulative memory with 4 keys, plus grand totalling; 3-digit counter with recall and clear; red print for negative indication; floating decimal, add/list mode for 2 decimal; rounding-off available; percent with add-on/ discount; direct root, 00 entry and CE; exchange of registers; non-add with sub-total. *Price: Rs 3112.25.*

WESTON

Printmax: 12-digit printer; without display; independent memory with provision for sub-total and total; percent with add-on/ discount; constant multiplication and division; repeat addition and subtraction; double item counter; 5/4 switch; floating/ fixed/ add mode decimal; square-root, CE, 00 keys; punctuation; non-add printing. *Price: Rs 2893.75.*

Printmax-12PD: Has all the features of Printmax, plus 12-digit display and a non-print switch. *Price: Rs 3241.*

Directory of Calculator Manufactures

(a) Those included in Buyers' Guide

Aristo: Business Machines Pvt Ltd, Asnani House, 10-A, Rajindra Place, New Delhi 110008.

Calcom: Calcom Electronics, 8-B/20 Jindal Trust Building, Asaf Ali Road, New Delhi 110002.

Candid. Kaycee Sons, 65-B Aram Bagh Place, New Delhi 110055.

Digical. NSH Business Machines (Private) Limited, Indo Bulgar Foods Building, Industrial Area, Delhi Meerut Road, Ghaziababd (U.P.).

EC Cal. Electronics Corporation of India Limited, Industrial Development Area, Cherlapalli, Hyderabad 500762.

Electron. Electronic Calculators & Computers Co, Spl. B-161 Peenya Industrial Estate, Bangalore 560022.

Elmer. Electronic Specialities Pvt Ltd, Club House, Subhash Society, Navrangpura, Ahmedabad 380009.

Keltron. Kerala State Electronics Development Corpn Ltd, Marikar building, II Floor, M.G. Road, Trivandrum 695001.

Logical. Logitronics, E-169, Kamla Nagar, Delhi 110007.

Master. Industrial Electronics, P.B. No. 16318, 8-Parvati Industrial Estate, Sunmill Compound, Lower Parel Bombay 400013.

Mecom. Meco-tronics Private Limited, 11A/1 Mount Road, Madras 600002.

Moscal. DCM Data Products, Marketing Department, I Floor, Kanchanjunga, 18 Barakhamba Road, New Delhi 110001.

Multiplex. Multivision Electronics, 69/71, Ghoga Street, Fort, Bombay 400001.

Omron. Omron India, 74 Regent Chambers, 7th Floor, Nariman Point, Bombay 400020.

Orion. Singh Radio Co (India) Pvt Ltd, 21 Darya Ganj, Ansari Road, New Delhi 110002

Quical. India Electronics Corporation, 27, Kotkar Industrial Estate, Off Aaray Road, Goregaon (East) Bombay 400063.

Remington. Remington Rand of India Ltd, Jivan Vihar, 3 Parliament Street, New Delhi 110001.

Simple. Applied Electronics, 10, Meghdoot Society, Karelibag, Baroda 390001.

Televista. 239 Okhla Industrial Estate, New Delhi 110020.

U M S. UMS Radio Factory Pvt, Ltd, P.O. Box No. 3771, Avanashi Road, Combatore 641018.

Weston. Weston Electroniks Limited, Okhla Industrial Estate, New Delhi 110020.

(b) Others, as per EFY records

Atlas. Atlas Radio & Electronic Industries Pvt Ltd, Plot No 57, GIDC Industrial Township, Naroda.

Bush. Bush India Limited, P.O. Box 4127, Sukh Sagar, N.S. Patkar Marg, Bombay 400007.

Devidayal. Devidayal Electronics And Wires Ltd, 25 Shrungar Shopping Centre, 12/12A, M.G. Road, Bangalore 560001.

Digital. Digital Equipment Company Ltd, Block J 5 Habshiguda, Hyderabad 500007.

Intronix. Intronix (d) Pvt Ltd, 40 Community Centre, Naraina Industrial Area, Phase I, New Delhi 110028.

Multiplex. Multiplex Electronics, 69/71 Ghoga Street, Fort, Bombay 400001.

Multisciences. Multisciences Corporation, 207 Niranjan, 99 Marine Drive, Bombay 400002.

Nelco. The National Radio & Electronics Co Ltd, Unity House, 8 Mama Parmanand Marg, Bombay 400004.

Shreeshyla. Shreeshyla Timex Pvt Ltd, Shreeshyla, Kanakapura Road, Bangalore 560011.

Sonywell. Sonywell Electronics, 8 Ajmal Khan Park Area, Karol Bagh, New Delhi 110005.

Steve. Steve Lamba & Co, 63 Lado Sarai, P.B. No. 4530, New Delhi 110030.

Superior. Superior Electronic Systems Pvt Ltd, Unit 129, Champaklal Bldg, 105 Sion Koliwada Road, Sion East, Bombay 400022.

Telerad. Telerad, Saki-Vihar Road, Chandivli, Bombay 400072.

Vishal. Vishal Electronics Pvt Ltd, 46/47 Jerbai Wadia Road, Parel, Bombay 400012.

Complete Sets of EFY's 1977 Issues

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— *Circulation Manager*

PLEASE NOTE

Due to paucity of space we are unable to carry the 6th instalment of 'Cobol Programming' in this issue. The same will be continued from the next issue.

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Inside Front Cover (2-colour)	Rs 1100	Rs 1025	Rs 975
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1. 10% extra will be charged for a specific position for an ad to be published at an inside position, subject to its availability.
2. Full page bleed advertisements will also cost 10% extra.
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4. Business stipulations and other details are also available on request.

Contracts entered into up to August 1978 end would be honoured at the existing rates (effective since April 1977), for the duration of such contracts, up to a maximum period of 12 months from the first insertion.

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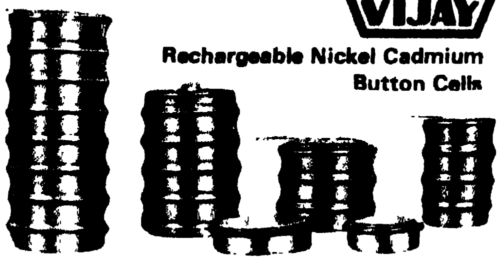

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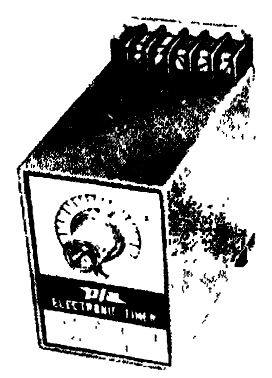

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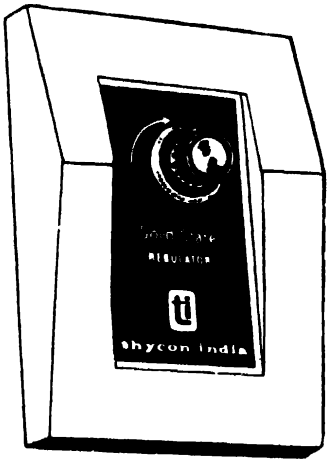

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Nagar,Jaipur 302004 (India)

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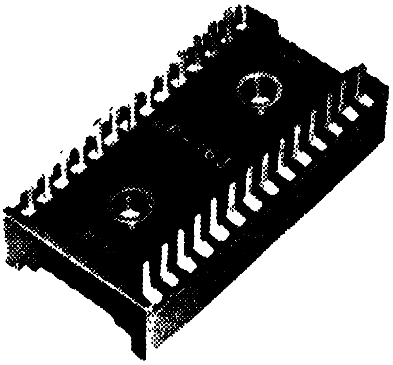

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TELECOMMUNICATION IN INDIA
The Past and the Future

J.A. Dave
Secretary, Ministry of Communications

The subsidiary but important supporting role of telecommunication services in the building up of the infrastructure in the growth and development of a nation or any of its areas is not often fully appreciated. Notwithstanding the widespread and numerous complaints against the efficiency of these services wherever they have been provided — criticism which certainly is not wholly unjustified — demand for these services continues to grow at a very rapid rate. No one who has started using these services or continues to do so for any length of time wants to give them up or have them discontinued. nor is the clamour for introduction of the facility in areas which do not have it subsiding; in fact, that is also a continuously growing demand all over the country.

All these are a measure of the importance and utility of this service as well as its essentiality. This is also abundantly established by the phenomenal growth of these services in the country since Independence. Just prior to that, there were hardly 80,000 telephone connections, about 300 telephone exchanges and 300 telegraph offices in this vast country. At the end of 1977, the country had 1.68 million telephone connections, 5948 telephone exchanges and 15,555 telegraph offices.

This growth has been possible because of the realisation of the important role of telecommunications in the national economy and progressively increased outlays provided for it in the successive five year Plans. The outlay for the first Plan (1951 to 1956) was only Rs 470 million. The size of the approved fifth Plan was Rs 11,890 million. The tentative financial outlay for the next Plan (1978 to 1983) has been placed at Rs 18,480 million.

The changing technology and the development trends

Over the years there have been continuous technological changes and advancement in both the major fields of telecommunications,viz, switching and transmission. Continuous efforts are being made to adapt our organisation to the new technology. The local telephone exchange systems have been progressively automatised and, at present, about 99 per cent of the telephones in the country are automatic. Manual telephone exchanges are being progressively replaced by automatic exchanges consistent with the availability of switching equipment.

With the economic and industrial development of the country, the demand for trunk telephone services has also been increasing rapidly. Till about the mid-fifties, all trunk telephone services were on manual basis. Then semi-automatic trunk operations involving single-link operator trunk dialling were introduced. This was followed by the introduction of the subscriber trunk dialling system for which a national switching and transmission plan was drawn up. This S.T.D. on a point-to-point basis with an access code of '9' was introduced in late fifties and is now in operation on more than one hundred routes. The national S.T.D. with '0' access code using trunk automatic exchanges was introduced in the mid-sixties.

There are now 15 trunk automatic exchanges in the country. The provision of subscriber trunk dialling networks has been made possible with the introduction of coaxial cable and microwave radio relay systems in the national trunk network. These systems enable provision of large blocks of high grade and highly reliable circuits between the various trunk centres. There are now over 13,600 route kms of coaxial cable systems and 11,250 route kms of microwave systems operating in the country.

The telex service was introduced in the country in 1963 and became immediately popular. This service is of great importance to trade, commerce and industry as well as the administrations in the country who have greatly welcomed it. There are now 18,750 working lines in the country.

Side by side with the development of terrestrial network, projects have been taken up for the introduction of satellite communication in the country. For meeting the communication needs of the remote areas, quarter transponder is being rented from INTELSAT (International Telecommunication Satellite) IV to provide reliable telecommunication facilities to our remote area locations by installation of two main earth stations — one each at Delhi and Madras — and 5 smaller stations at Port Blair, Nicobar Island, Kavaratti in Lakshadweep Island, Leh and a suitable station in North Eastern area. In the second phase, a domestic satellite (INSAT) providing for telecommunications, TV and meteorology has been planned with 35 earth stations.

Overseas telecommunication services

Along with the development of extensive, diversified and efficient telecommunication services within the country, considerable importance has been and will continue to be given to establishing, operating and maintaining the external telecommunication services of India. These are taken care of by the Overseas Communications Service of the Ministry of Communications. Since its inception on

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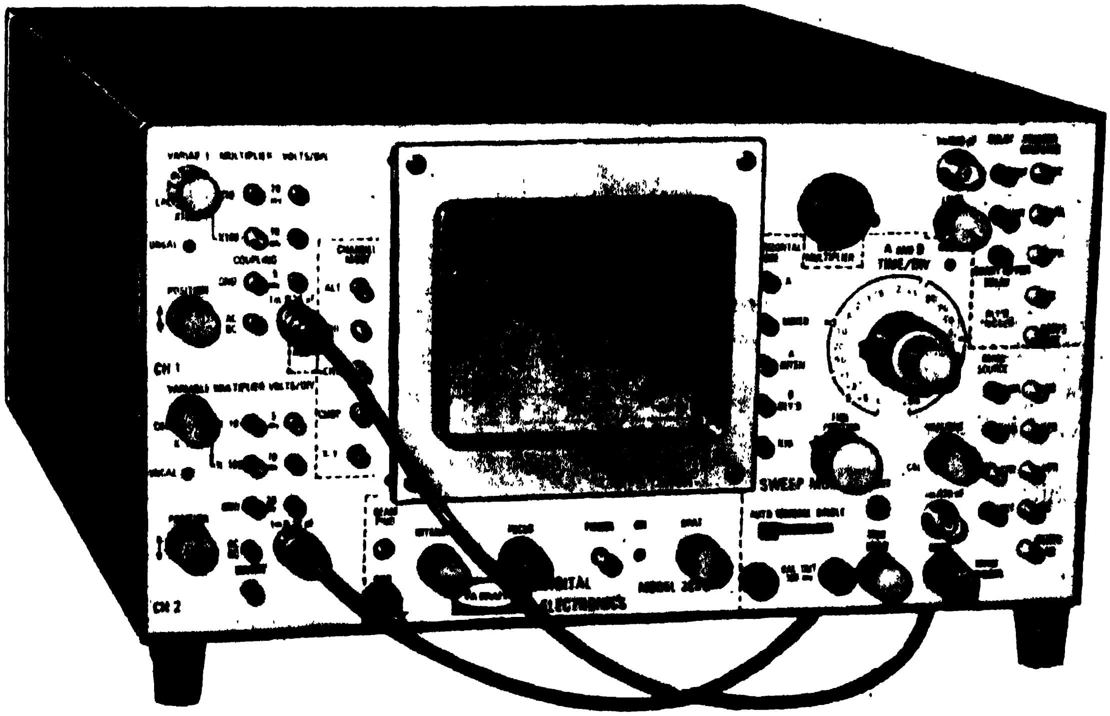

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32194 35136**

January 1, 1947, this organisation has modernised the external telecommunication system by changing over from higher frequency radio to broadband satellite communication providing an efficient, reliable and large-capacity telephone, telex and telegraph service with other countries. Plans have been drawn up for the introduction of the troposcatter communication, submarine telephone cables and other modern telecommunication systems currently being used by the advanced countries. At present, the O.C.S. handles about 99 per cent of the international telephone, 95 per cent of telex and 75 per cent of telegraph traffic via the INTELSAT satellite system.

During the fifth Plan the Vikram Satellite Earth Station at Arvi and the Videsh Sanchar Bhavan, Bombay, were augmented to work with more countries and the Ahmed Satellite Earth Station at Dehra Dun was commissioned and connected with Videsh Sanchar Bhavan in New Delhi. International subscriber dialling has been introduced from Bombay and New Delhi to United Kingdom on a 24-hour basis. The international telex automatic exchange capacity at Bombay has been augmented by the installation of S.P.C. type telex exchange with 450 international lines capacity.

The new strategy

Although the development of telecommunications in the country over the last three decades has been very fast, it has been, by and large, city-oriented and the rural areas have been somewhat out of focus. With the new government assuming office last year and direction of its policies towards decentralisation of the processes of the government with the objective of securing rapid, integrated and intensive development of the rural areas, the expansion of telecommunication services in the rural areas and particularly the hilly, backward and remote areas has been given heavy weightage to provide adequate support to and facility for the reoriented public policies. The principal objectives of the new policy of telecommunications, therefore, are:

(i) Rapid expansion of these services in the rural areas and new growth centres;

(ii) provision of these services promptly and on demand in small towns, cities and satellite towns to metropolitan areas to help implementation of the policy to reduce the pressure on these areas, and

(iii) to bring about a quick and effective improvement in these services in the metropolitan and other large cities.

The rural bias

Against the above background of catering to the needs of the rural backward, hilly and tribal areas where the needs can be met primarily by long-distance public call offices and telegraph offices, a target of opening 4000 public call offices and 4600 telegraph offices during the two years' period 1977-79 was fixed soon after the new government came into office.

Considerable advance has been made in 1977-78 itself in this direction. There are now in the country 15,555 telegraph offices and 7136 long-distance public call offices. In these total figures, the addition during the year 1977-78 itself is expected to be 1333 public call offices and 1358 telegraph offices.

The 1978-83 plan, its content and outlay

The fifth Plan for telecommunications has terminated on March 31, 1978. A new Plan for the period 1978-83 has commenced from April 1, 1978. A draft telecommunication plan for this period with a tentative financial allocation of Rs 18,480 million is now awaiting consideration by the National Development Council. The strategy of the new Plan and its principal thrust have already been referred to earlier. The extension of the telecommunication facilities to the rural areas will be through the provision of 15,000 new long-distance public call offices. The attempt will also be to provide telephone connections in rural areas, smaller towns and new growth centres practically on demand and to improve the trunk service from such places to a considerable extent including the extension of subscriber trunk dialling system to the secondary centres. In the metropolitan cities, the effort would be to meet the existing demands in full and provide additional exchange capacities and telephone connections to remove congestion and overloading in the existing networks, both local and trunks.

An addition of 1.15 million direct exchange connections, with possibilities of further increase if justified, to the existing network has been envisaged during the Plan period. Over 44.8 per cent of the total proposed Telecommunications Plan outlay of Rs 18,480 million is proposed to be invested on the development of telecommunication network in the rural, tribal and semi-urban areas. A specific allocation of Rs 375 million is being made for the provision of these services in the tribal areas.

The new Five Year Plan for O.C.S. provides an outlay of Rs 706.2 million with a proposal to introduce international subscriber dialling on telex from all over India. A troposcatter communication link between India and the USSR and the Indian Overseas Commonwealth Cable project for establishing a wide-band submarine telephone cable link between Madras and Penang, are also provided in the next Plan. Another major item of investment will be India's participation in the International Maritime Satellite Organisation.

Research and development

An investment of Rs 200 million has also been proposed in the new Plan for research and development. These activities are being directed primarily towards the introduction of new technologies in the telecommunications network and also for investigation and improvement of the performance of the existing systems. Steps are already being taken for evolving a more efficient and reliable switching system for the country and development of technology for the rural telecommunication facilities. The electronic switching systems for local, trunks and telex and PCM with digital microwave systems for junction working, are some of the new technologies that will be introduced in the telecommunications network during the new Plan.

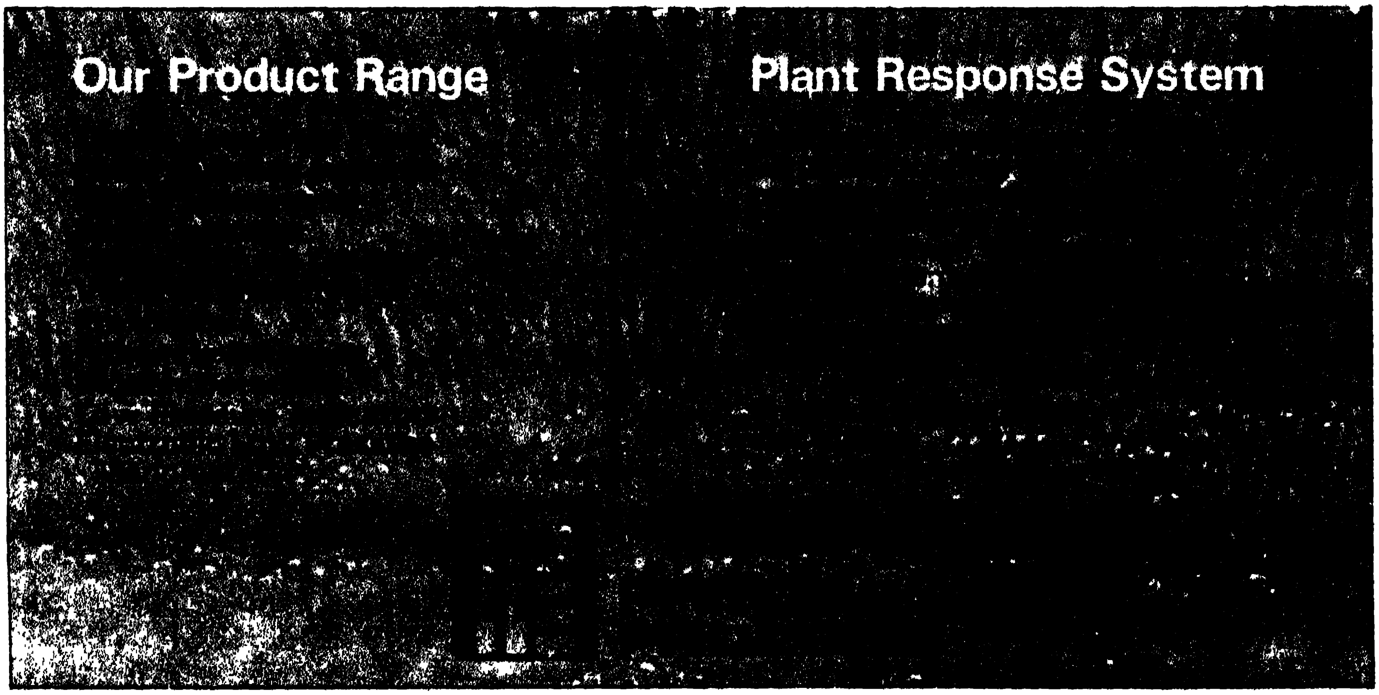
Role of the Indian Telephone Industries

The rapid progress in the development of telecommunication services since Independence and the expansion now proposed during the next Five Year Plan period have, by and large, been possible as a result of the manufacture both of the switching and transmission equipment by the Indian Telephone Industries. Since the time it was set up in 1948, the expansion in its manufacturing capacities and production of different items of equipment have more or less kept pace with the requirements of the P&T services.

There has been close cooperation between the Telecommunication Research Centre of the P&T and the Indian Telephone Industries as a result of which a number of items have been developed and productionised by the latter. Improved cross-bar telephone exchange, narrowband microwave systems, coaxial line equipment, VFT equipment, etc are some of the major items of production resulting from the joint development effort of the Telecommunication Research Centre and the Indian Telephone Industries. They are now engaged in developing broadband microwave systems, PCM systems, earth station equipment, etc which will be manufactured and utilised during the new Five Year Plan.

The development of new technologies in the field of telecommunications in the advanced countries has been so rapid in the last few years, and continues to be so, that there is a feeling all the time amongst the developing countries of being left behind. We in India are not an exception to this general proposition. In this field our technologists have attained high standards. This fact has gained recognition in the international sphere also. They can evolve and adopt new systems. The expectations of the people regarding the reliability and efficiency of the telecommunication services are going high and this requirement has necessarily to be catered for. But whatever systems we adopt for the future have to take into account not only this expectation but also, and more importantly, the main objective of providing a utility service which will give satisfaction to the masses. The systems which we adopt for mass production in the country during the next ten years or so will, as such, have to meet this primary objective and not merely the consideration of being ultra-modern. □

Our Digital Monitoring envisages the required accuracy



A Step Towards Classroom Automation

H. L. Talwar and B. Sohleinig

With the objective of providing practical training to diploma engineering students the development of a compact and foolproof electronic feedback classroom system was taken up as a project in our institute. It resulted in a system which can be used in almost all educational institutes. The components used are all indigenous.

This classroom system is designed to accommodate fifteen students with independent terminals to answer multi - choice questions (up to four possible choices each) with individual right and wrong indications available on every desk. A centralised answer display (optional) unit for answer indication is also incorporated for the teacher to display the right answer to the whole class.

The test procedure is introduced and set by the teacher incharge of the teacher's panel. A question with up to four possible answers is either announced or projected. A prepared question - answer sheet can also be provided. The students are required to give their answer choice by pressing one of the four input pushbuttons (A, B, C, D).

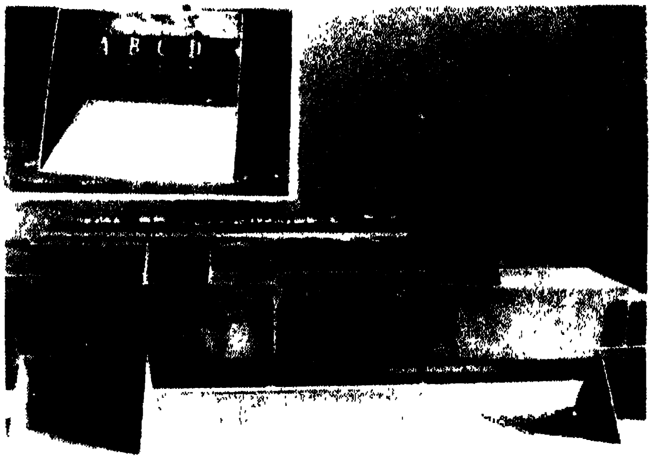
Foul inputs and doubling are avoided by interlocking the circuitry. Each answer is displayed and automatically stored at the teacher's board against individual seat numbers respectively.

After receiving answers from all the students at the termination of the alloted time, the teacher presses feedback pushbutton, thereby actuating the right/ wrong logic and simultaneously feeding resultant information to the students. Thus a silent communication is established between the teacher and the taught.

All stored answers on the teacher's panel are cleared by pressing the reset pushbutton. Hence the unit is made ready for performance of the next question - answer set. The number of questions per set is not limited, but it depends upon the available test time. To avoid possible interruptions during tests due to power failure, a battery - buffered mains power supply is used. As such there is no danger of a severe shock in touching any part of the circuitry and installation. The entire project is mains - isolated and shock - proof. The actual circuitry adopted needs no special temperature compensation and ventilation at all.

Students' panel

The system is arranged to provide two students' panels on each classroom table. Four answer signals are generated with simple normally - open type pushbuttons which are mounted adjoining to a light - emitting diode fixed on bakelite plate. In order to screen each seat from the neighbouring one, the bakelite plate is fixed in a sheetmetal box which also covers the wiring and mechanical fixture of the components.



A view of the classroom automation system in use at the Y M.C.A Institute of Engineering, Faridabad (Haryana). Inset: a close-up of a student's answer box.

For a particular question the student will press one pushbutton out of the four marked A, B, C and D. The student who has sent the right answer will get confirmation through LED at his panel.

For the sake of economy, the system is built in such a way that the student who has sent the wrong answer would not know the right answer unless it is announced by the teacher to the whole class. It is possible however, though costly, to inform the right answer individually to each student instead of one in each of the students' terminal boxes by providing four LEDs.

Teacher's panel

The right - answer logic and display unit are arranged in a rack on printed circuit boards of the teacher's table. The circuit boards are built up as universal input modules with storage and interlocking circuitry for four signals per student panel by means of reed - relays - diode logic. To indicate incoming signals, four light emitting diodes are mounted on the top of each printed circuit board.

The PCBs are connected by edge connectors which are fixed in the rack - frame. The students' panels are connected with similar edge connectors through multicore telephone cables. These edge connectors are fixed in specially designed holders which prevent the PCBs from moving in the rack - rail channel.

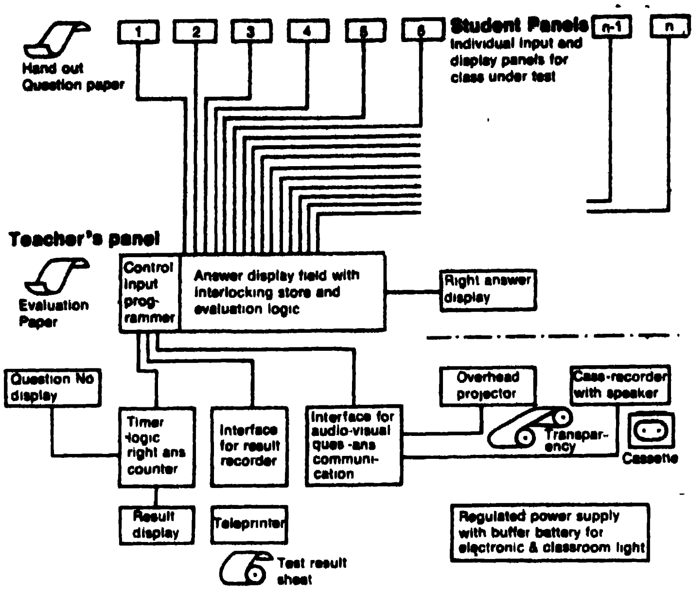
A piano type pushbutton switch arrangement is used for right - answer signal input and feedback signal actuation. The top side of the rack is covered with a rubber mask showing all the essential operating elements and the spectrum of fifteen times four LEDs consolidated answer display. A triangular - shaped roof covers this panel in order to screen the input operation of the teacher from the rest of the class under test.

Right-answer display

This unit is mounted on top of the teacher's table, standing about 60 cms high and inscribed with large A, B, C, D letters. Four indicating lamps (24V, 2.4W) are installed symmetrically, one beneath each letter. This unit can be switched on/off by the toggle switch provided on the right bottom corner of the panel. The wiring is done with a cable - tree and coupled in the same manner as in the case of earlier described logic PCBs.

The whole project provides various training activities like selecting and testing of components (such as reed - relays, LEDs, switching diodes, piano - switch combination, edge connectors and multicore cable etc), estimating, procurement, fabrication and installation technique. It includes the main task of carrying performance test on PCB and the completely - built system.

The existing system does not only serve the class tests but is a source for future development activities towards a more sophisticated system. This system may be used to create a students' project in some technical institutes.



Hand out Question paper
1
2
3
4
5
6
Student Panels
Individual input and display panels for class under test
n-1
n
Teacher's panel
Evaluation Paper
Control input programmer
Answer display field with interlocking store and evaluation logic
Right answer display
Question No display
Timer logic right ans counter
Interface for result recorder
Interface for audio-visual ques -ans communication
Overhead projector
Cass-recorder with speaker
Transparency
Cassette
Result display
Teleprinter
Test result sheet
Regulated power supply with buffer battery for electronic & classroom light

A block diagram of the classroom automation system developed and installed in the Y.M.C.A. Institute of Engineering, Faridabad (Haryana).

For example, a question - time limiter may be designed to give the teacher an additional facility to pre - select an appropriate time for every specific question. Another interesting possibility is to include a blinking signal indicator at all student panels. Blinking should commence shortly before the allotted question time is over and input should get blocked no sooner the time is terminated. ☐

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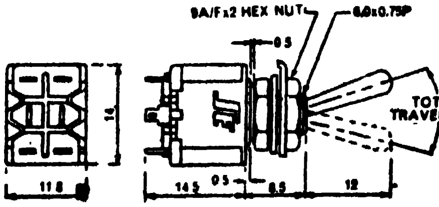
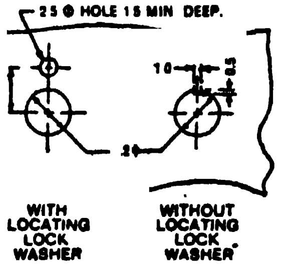


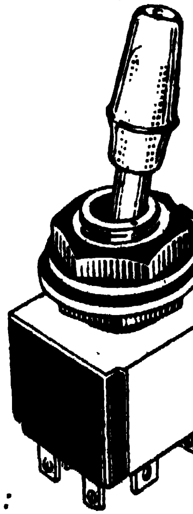
TOGGLE SWITCH MODEL-T 2A



RECOMMENDED PANEL CUT-OUT

SPECIFICATIONS

CIRCUITRY	Double Pole—Double throw
CURRENT RATING	: a) 2 amps. 250V A.C. 50 c/s b) 4 amps. 30V
CONTACT RESISTANCE	Below 10 milliohms
INSULATION RESISTANCE	500 Megohms (min)
LIFE EXPECTANCY	20,000 cycles/min. operation
ACCESSORIES	a) Coloured Plastic Caps for identification of controls b) Knurled mounting nut or Decorative mounting nut.



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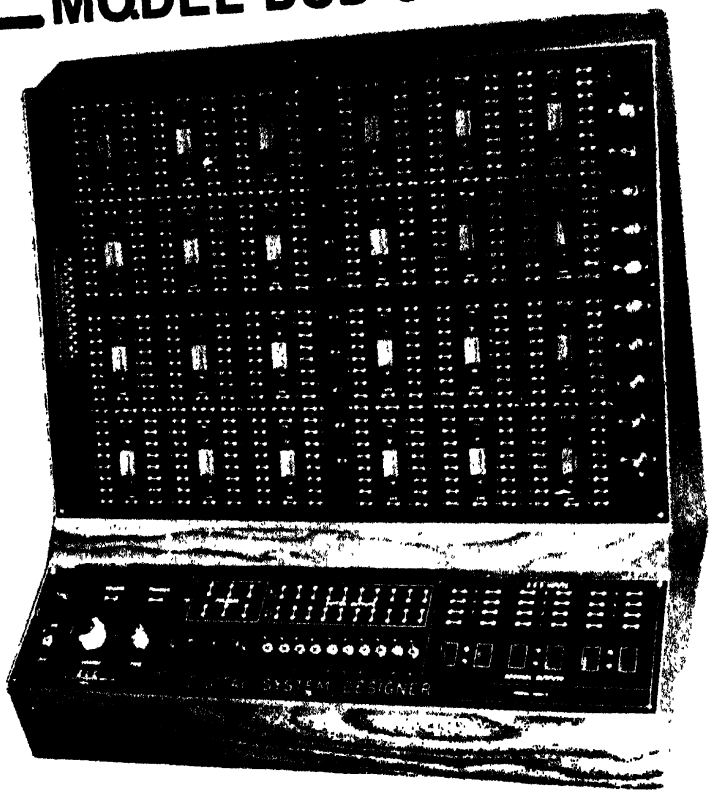

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MODEL DSD-3 & DSD-4

The AEC DIGITAL SYSTEM DESIGNER, Model DSD-3 is a very versatile and completely self - contained laboratory demonstrator and a digital system development instrument to enable the user to conduct simple and advanced experiments in combinational and sequential logic circuits, using third and fourth generation digital integrated circuits, for training and simulating industrial designs, in a solderless way.

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This method considerably cuts down time from the idea stage to the final design.

It uses 24 numbers of 16-pin dual in-line IC sockets and one 22-pin edge - connector, for quick and solderless interconnections and disconnections.

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It is a completely self-contained device and has everything needed to assemble and test the logic circuits, with built-in input signals and output indicators, such as power supplies, clock signals, pulsers, logic status indicating lights, various logic switches and digital displays This method clearly eliminates the combersome method of assembly of a maze of component boxes, separate power supplies, pulse generators, logic indicators, IC base assemblies, logic switches etc, strewn all over the work-table which are otherwise required to build and test these digital circuits

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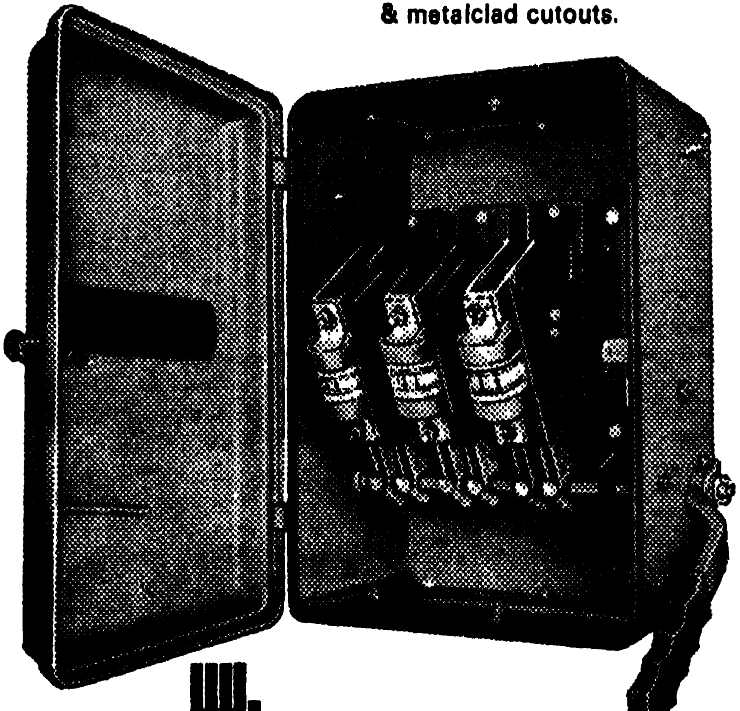

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INTELLIGENT PERIPHERALS

J.E.T. Sargunar

This article is more concerned with small and medium computer systems. The fundamental concepts utilised in this article, however, apply to any magnetic or input/output peripheral, although particular attention is paid to diskette drives which are random access peripherals.

The present trend in the computer hardware manufacturing industry is to set up various and sometimes unrelated standards and specifications for each peripheral, thereby promoting an independent technological race for each of these peripherals, without taking into account how these new products may be used in producing better computer systems. Very often these higher performance peripherals cannot be used for want of suitable controllers and software in existing computer systems. By the time these are available, the devices have been superseded by better peripherals. The object of the exercise must be to develop a computer hardware configuration so that new peripherals are readily acceptable by existing computer systems.

Therefore it is not advisable to manufacture diskette drives with a minimum interface, as IBM have. The controllers then have the problem of keeping up with the rapidly improving peripherals. The minimum interface philosophy may suit the IBM system architects, but does not solve the said problems. We need to partition the computer system in such a way as to enable the ready use of more modern peripherals without hardware and software modification. The best place for such a partition is at the processor memory bus itself. One way to look at the problem is to lump the controller and the peripheral so that the peripheral looks as if it is a core memory extension. As long as the additional memory can be handled by the processor there is no need for any hardware or software modifications. One simply plugs in another peripheral, and the processor treats it as additional memory. The article discusses some of the problems and aspects of this concept with particular reference to diskette drives.

Diskette based intelligent peripheral

To make a diskette drive appear as core extension, there is a fundamental problem about access time. Core memories have fixed access and read times that may be suitably clocked by the processor. The diskette drives have access times that depend on the latency of the disk as well as the number of tracks to be accessed. Therefore the processor must wait until access is completed, and even then bit/ byte/ word address is not possible, and only whole sectors may be transferred at a time. Data transfer to and from diskette is also serial. These problems are overcome by raising an interrupt to the processor from the diskette, until the following are completed:

- Access to required track
- Wait during the latency period, while the head waits for the addressed sector to come around
- Transfer sector as required to buffer area
- Check for error, and initiate retries to ensure data integrity
- Release interrupt

The processor then finds the addressed sector transferred to the specified sector address, from the buffer memory. The data within the buffer memory may now be addressed as though it were core-memory. The interface is as simple as the memory interface. When a particular bit/ byte/ word is addressed, the particular sector is obtained from the peripheral and the data operated from buffer memory.

Refer the system configuration

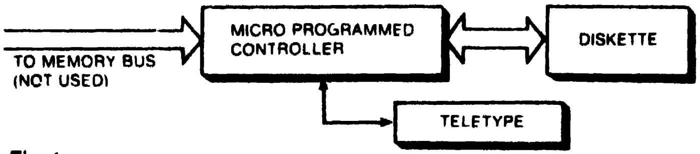


Fig. 1

Let us assume that the 250k words of data may be stored in a diskette drive, after the necessary data formating, in sectors. The memory bus after connecting the processor to core (or semiconductor memory), further connects to the intelligent peripherals.

When a fetch instruction is to be executed, the processor sends an address via the memory address lines. If this address falls within the addresses controlled by a particular intelligent peripheral, it causes a processor interrupt and performs all the functions described earlier thus transferring the entire sector to the buffer memory, when the interrupt is released. The processor may then address any address within the transferred sector without further disk drive operation. The peripheral control may, if no other task is forthcoming, transfer adjacent sectors to buffer memory in case data from these sectors are required. Usually data is required from adjacent sectors. Some time may be saved in this way.

On completion of data processing, if another sector is required, assuming the data in buffer memory is modified in some way, one may need to restore the modified sector back to the diskette. Read after write operations may be needed to preserve data integrity, a task suited for micro - processor and similar devices.

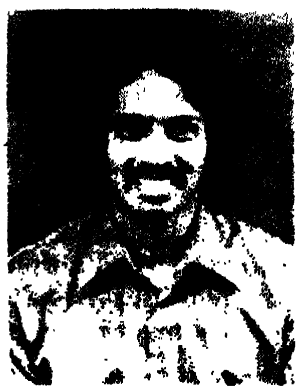
It is reasonable to assume that several such peripherals will be used in a computer system. Therefore the address range that each peripheral would be concerned with would depend on the diskette that is loaded in the peripheral. Some information, therefore, needs to be stored in the diskette for such identification. It is fitting to use the diskette to store the microprogrammes for the intelligent peripherals control. Track - zero of each diskette may be used to store the above, and is not used for conventional data.

In a user environment there may be several peripherals for diskettes, and each peripheral will respond within the range of the diskette that is loaded. If a diskette that is needed is not present, the processor will discover this after a delay (greater than the maximum diskette access time) and inform the operator to load the specified diskette. Naturally these diskettes may be loaded into any drive. The data formats on track - zero may be written by the diskette drive controller itself on new diskettes using a teletype, in a stand-alone mode.

Microprocessor Intelligence

This section relates to distributed intelligence concepts. Since varied and several tasks are required of the intelligent peripheral controller, a microprogrammed controller that obtains its microprogrammes from the diskettes itself and/or from ROMs is best suited. It is now feasible to obtain such microprogrammes and execute them as required. The tasks that may be executed by microprocessor in this context are as follows:

1. Enable stand-alone operation of peripherals with teletype: useful in initialising virgin media and in small business applications.
2. Assist with diagnosis
3. Perform error detection and correction preserving data integrity
4. Prevent over-write on protected sectors
5. Enable use of better drives (more number of tracks etc) by simple firmware modifications to the microprogramme
6. Obtain and execute microprogrammes from protected sectors in diskette
7. Copy diskettes using two or more drives in stand-alone mode
8. Monitor power-supply and DC supplies, and inform the processor if a fault is noticed
9. Monitor soft and hard errors, and store them on the diskettes itself in the protected area. If more than a specified number of soft/hard errors are present, a media change request may be made to operator. The detailed error history may also be recorded so that the drives where errors occured are also known.



Mr J.E.T. Sargunar, graduated in electronics from the Indian Institute of Technology, Madras, in 1969. He was employed as a development engineer at Data Recording Instruments Ltd (ICL group) at Staines, Middlesex (UK) and later as project engineer in charge of advanced development at Burroughs Corporation, Glenrothes (UK). Then he became managing director of INSCO Electronics, Glenrothes (UK) where he developed a range of test equipment and power supplies.

Presently he is the managing director of SEAF Computer Products (Pvt) Ltd, Madras, and chief executive of the International Power Company, Madras. He has several international patents in computer science and peripheral techniques, magnetic recording and digital systems to his credit.

Error detection & correction

Following a read operation from diskette, the controller can perform parity, cyclic redundancy and other error detection checks on data in buffer memory. If an error is detected, a 're-read and compare' routine may be initiated until the error is eliminated, subject to a specified maximum number of re-tries.

Similarly, during a write operation to diskette, a read - after - write routine may be initiated to check correctness of data transfer. These error detection and correction operations are transparent to the processor and autonomously executed by the controller, and will not slow down the data processing unless severe disk work is attempted.

Stand-alone operation of diskette

Refer the diagram below:

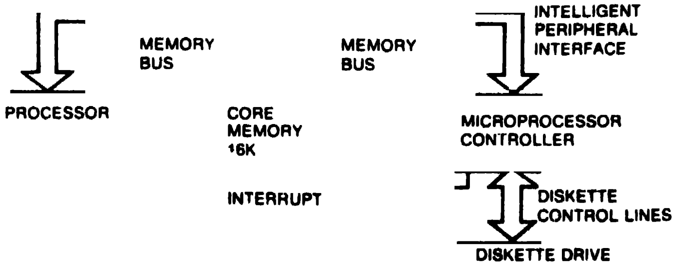


Fig. 2

Now that we have a microprogramme controlled intelligence in the form of a microprocessor, supported by magnetic data storage device, low-level programmes may be executed. Stand-alone operation is suitable for small business applications where the data processing needs are fixed: for example, payroll programmes. The speed of printing is limited to teletype speeds.

Although features such as error detection and correction are available, it is rather difficult to write programmes in low-level languages. However the programming is made easier as data processing is confined to the buffer area only, the transfer to and from diskette being transparent to the programmer.

The stored data may be printed out on teletype, and correction may be made. Data preparation and verification is possible using only an intelligent peripheral and a teletype. Therefore if a computer system has four intelligent peripherals, one to three of these may be used for data preparation/ verification off-line, and the remaining for virtual memory. The system flexibility, from the user's point of view is improved.

Summary

These intelligent peripherals lend so much flexibility to each hardware block, and increase their utilisation considerably. Systems can be envisaged where the processor performs only data processing, accepting data and generating output in diskettes. The output diskettes are loaded to an intelligent printer using an intelligent diskette drive so that printing is no longer done 'on-line' during data processing. Both the printer and the processor approach maximum utilisation, leading to better use of hardware, and increasing cost effectiveness.

The concepts of distributed intelligence have been proved long ago, and we are only just beginning to understand them and finding ways to put them to use. □

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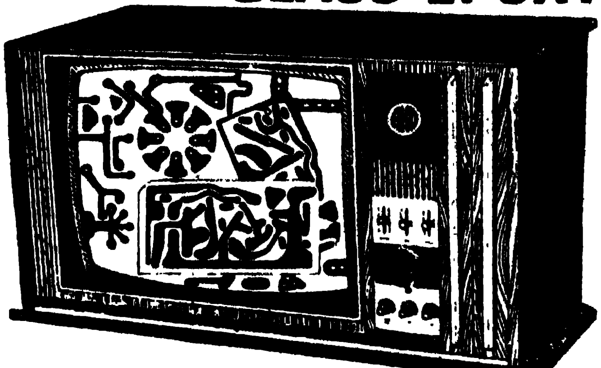

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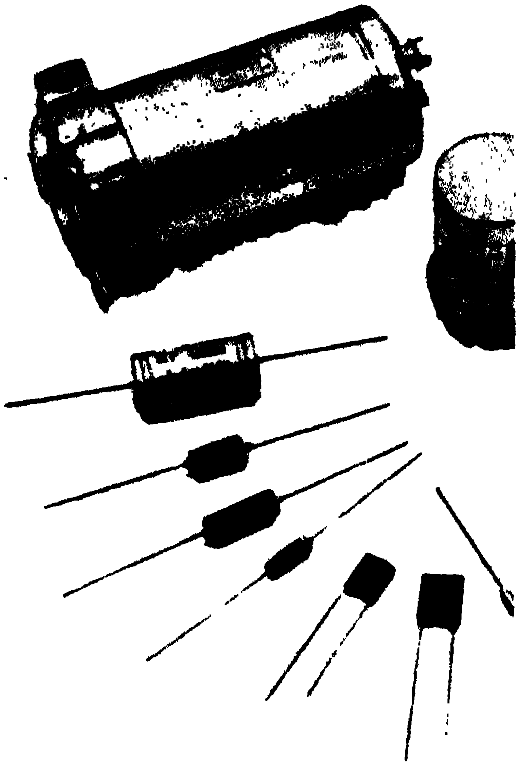

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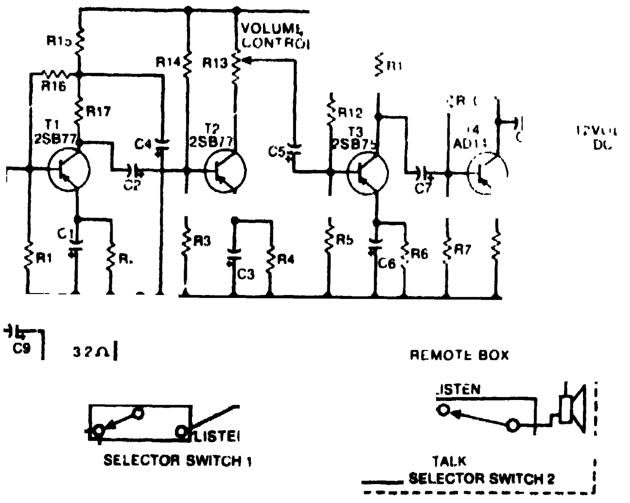
CIRCUIT IDEAS

Make Yourself This 4-Transistor Intercom

This intercommunication system is basically a 4-stage RC coupled amplifier, which provides excellent frequency response. The power output of the amplifier is quite high, being approximately 750 mW. RC coupled stages of the amplifier eliminate the use of any matching transformer. Sound quality is excellent and, therefore, the need for any tone control is unnecessary.

Transistor selection is not very critical. Although easily-available transistors like 2SB77 and 2SB75 have been used, other transistors like OC72 (or AC128) and OC71 (or AC125) can be equally applicable for T1 and T2 or T3 respectively.

T4 is a power transistor. It should be mounted on a heat sink or a 10cm x 6.3cm aluminium plate of 2mm thickness.



Power consumption of the circuit is quite appreciable, about 250 mA. Therefore, for continuous running, use of a battery eliminator is suggested.

Two loudspeakers of 3.2 ohm or 5 ohm impedance may be used. The loudspeakers should be capable of withstanding the audio power output. 10cm loudspeakers are suggested, although 6.3cm loudspeakers may be tried — sacrificing some volume. Two selector switches and three-wire connection between the two units are provided. Either of the unit can, therefore, be used as the master unit or sub unit.

All connecting wires in the circuit should be as short as possible. The entire circuit can be assembled in a plastic box with perforations for air circulation. Resistors R7 and R10 become hot during use and, therefore, these should be mounted in a separate board, near the ventilation holes.

PARTS LIST

Transistors (See text)
T1, T2—2SB77
T3—2SB75
T4—AD149
Capacitors (All electrolytic, 25V)
C1, C7—100 µF
C2, C4, C5, C8, C9—25 µF
C3, C6—50 µF
Resistors (All ½W, unless mentioned otherwise)
R1—2.2 kilohm
R2—650 ohm
R3—5.1 kilohm
R4, R5—330 ohm
R6—39 ohm
R7—47 ohm, 1W
R8—1.5 ohm, 2W
R9—5 ohm, 10W
R10—220 ohm, 1W
R11—68 ohm
R12—680 ohm
R13—1 kilohm log. potentiometer
R14—22 kilohm
R15, R17—6.5 kilohm
R16—22 kilohm
Misc.—Two 2-way switches, 4 to 6 metre 3-wire cable, two loudspeakers (see text), 12V DC supply (battery eliminator), heat sink for power transistor T4, cabinets for the main unit and sub unit

For operation, the three wires connecting the two units can be four to six metres long. If the wires are too short, or if the two speakers are brought too close, a howling sound would be produced through the speakers due to acoustic feedback through air.

GAUTAM TALUKDAR
Calcutta

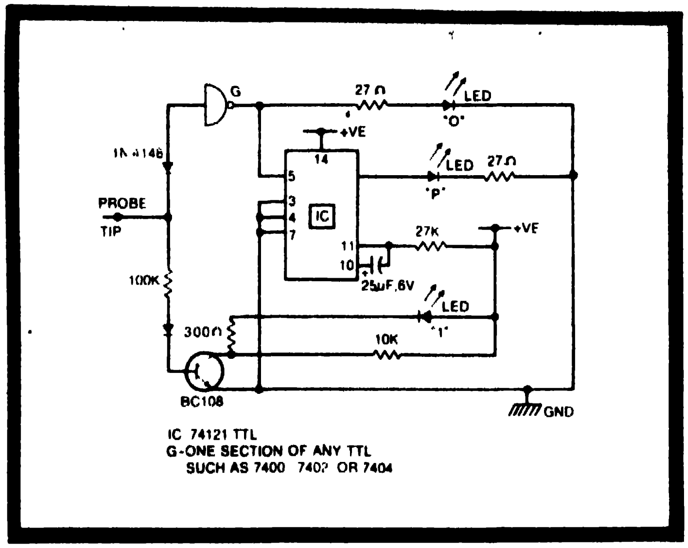
3-LED Logic Probe

Here is a simple logic circuit which is much more economical than a commercial unit.

A high level logic at the probe tip causes the transistor to conduct, thus illuminating the LED marked '1'. A low-level logic produces a high at the output of the inverter 'G' causing the LED marked 'O' to be lit.

If, however, the logic level at the probe tip is being pulsed, the monostable IC 74121 (TTL) will detect the pulses and stretch them to about 0.4s duration. The LED marked 'P' will then flash briefly. For quick detection, while using the probe, LEDs of three different colours can be used.

This simple logic probe uses a 5V regulated power supply. The power supply can also be drawn from the circuit under test. But power supply should not exceed 5V. The inverter 'G' can be any one section of TTL package such as



7400, 7402 or 7404, with its inputs paralleled.

The total cost of the probe is around Rs 50. Prototype was assembled on a piece of dot matrix board with point by point wiring.

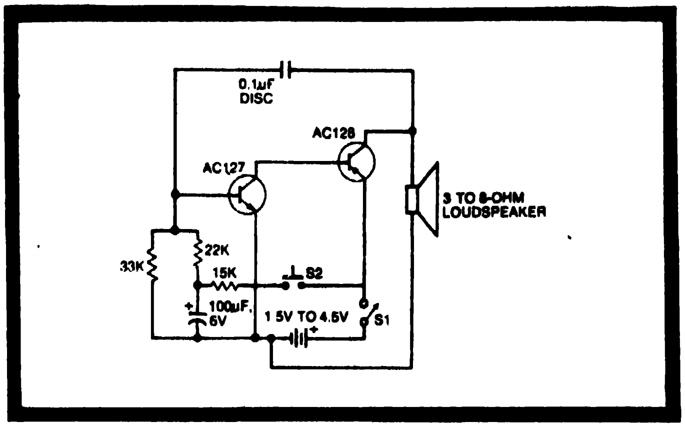
M. KALEEMULLA
Bangalore

Siren

Here is a simple circuit to give you a room-filling Police doorbell, in intruder alarm circuits and for other general audio purposes.

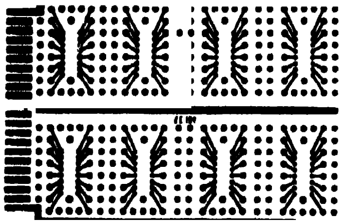
The circuit produces a shrill siren when pushbutton switch S2 is depressed. S1 is the main switch to switch the unit on/off. The loudspeaker should be as small as possible to get a shrill sound.

Battery can comprise one to three standard 1.5V cells. As current consumption is very low, penlight cells can also be used.



Wiring is not critical, and the entire unit can be constructed on a small piece of PCB or groupboard.

R.K. KAKKAD
Rajkot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Plastic Covers for DY 802
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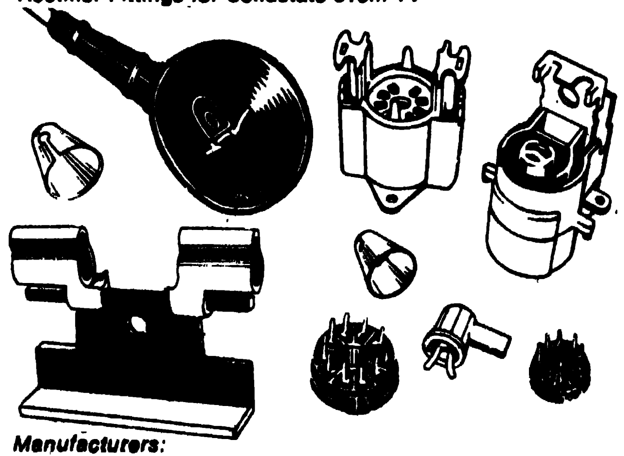
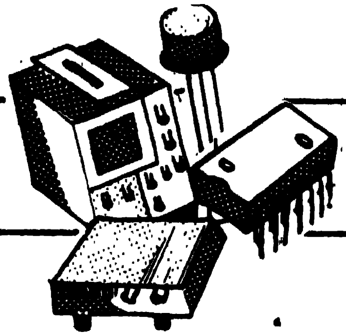
Rectifier Fittings for Solidstate 31cm TV


Manufacturers:
TELEVISION SERVICE CENTRE (Regd.)
Saraswati Marg (Below Telegraph Office),
Karol Bagh, New Delhi-110005.
Phones : 567552/580076



PRODUCT PROFILES

LCD DISPLAYS

Central Electronics Limited (CEL) a government of India enterprise, has recently introduced the liquid crystal displays, "CELCD", the latest kind of displays in the market. CELCDs developed by CEL, through its own R&D efforts, utilise glass - to - glass hermetic seals and consist of most stable liquid crystal materials to give a typical operating life span of 50 thousand hours.

The salient features of liquid crystal displays are low power drain, quick response, wide viewing angle and excellent contrast, which make them ideally suited for battery - operated systems. Amongst the varieties of CELCDs being fabricated by CEL are:

(i) 3½ digits/5½ digits, with colon (:), and 'AM/PM" indications; character height 4 mm to 13 mm for watches and clocks.

(ii) 3½ digits/4 digits with decimals (.), plus (+) and minus (-) indications; character height 13 mm for multimer and panel meter etc.

(iii) 8 digits with decimals (.) and indications for memory (M) and overloading (E); character height 4 mm to 6 mm for pocket calculators.

CELCD 8-digit calculator displays have multiplexing schemes.

Contact: Officer - in - charge, Marketing Group (Displays), Central Electronics Ltd, 4 Industrial Area, Sahibabad 201005 (U.P)

MICROCOMPUTER TRAINER

Model MCT-1 is essentially a microprocessor - based microcomputer. It uses an 8-bit microprocessor (INTEL: 8080A).

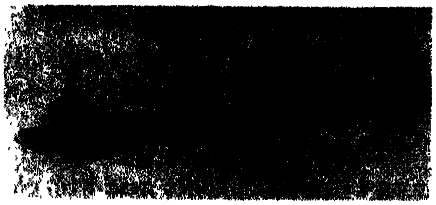
This trainer provides the required support to learn software, debugging, computing concepts, peripheral interfacing through sequence of events associated in program execution: thereby providing a hands - on experience necessary for understanding the operation of microprocessors. This experience is important for reinforcing basic concepts of hardware and software trade off.

The trainer is supported by good documentation with illustrative user - oriented software library. It is useful in educational institutions, research laboratories, and industries which are engaged in designing of microprocessor - based systems.

Contact: Allied Computers, B-58 Ashok Nagar, 48th Street, 9th Avenue, Madras 600083.

MAGNETIC HEADS

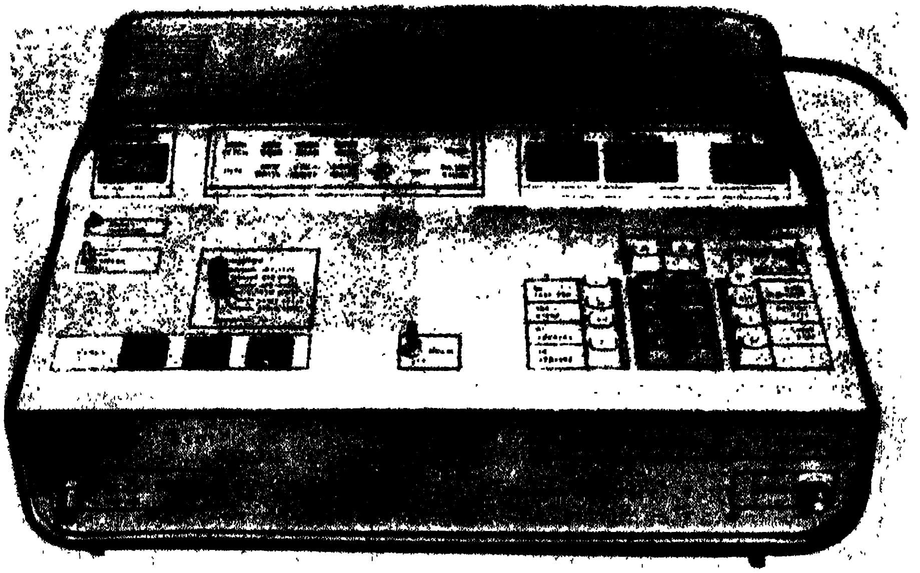
Associated Engineering Works claims to have developed and produced magnetic heads with completely indigenous equipment and own knowhow.



Its Record/Play and Erase heads for Japanese type cassette tape recorders are said to have good sensitivity and frequency response. A 3-terminal low - impedance head, suitable for European type recorders, has also been developed.

Its low-impedance playback head for super 8mm sound projector has a projected core with only 0.5 mm track width and therefore gives a good high frequency response.

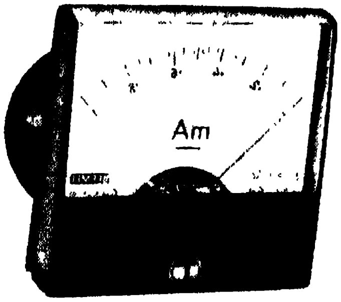
The company has also developed timing and reset pick-ups for electronic



printer calculators. It can undertake development of special type of magnetic heads, pick-ups and sensing devices as well.
Contact: Associated Engineering Works, Jail Road, Surendranagar 363001 (Gujarat).

PANEL METERS

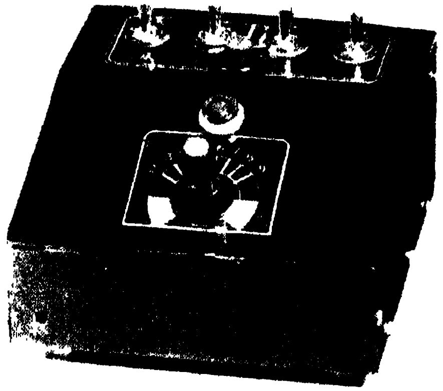
BEEMET CF group panel meters are available in moving coil and moving iron types, and are suitable for electronic test equipments, communication apparatus, control panels, machine tools, switchboards, process controls and other purposes. The instrument conforms with requirements of Class 1.5 ISS: 1248/68 accuracy stipulations. It is available in four sizes: 65 x 65 mm, 80 x 80 mm, 106 x 84 mm and 120 x 102 mm. The meters are housed in a dust - proof bakelite case with clear acrylic front and are available in the range of 25 μA to 5000 amps DC with suitable shunts and 10 mV to 600 V. External shunts are also available.
Contact: Bharat Electronics & Electricals, 140 Nagindas Master Road, 407 Commerce House, Fort, Bombay 400023.



ELECTRONIC TIMER

Venus electronic timer for the industry and for photographers' darkroom is provided with three step switches for time selection. Any required time can be preset on this panel. It has been tested and certified by a recognised testing laboratory for its quality and accuracy. It is a completely solidstate device.

The timer works on AC mains and is protected against short circuit. Price Rs 525.
Contact: Market Research and Project Consultancy Services, 23/4 Benson Cross Road, Bangalore 560046.

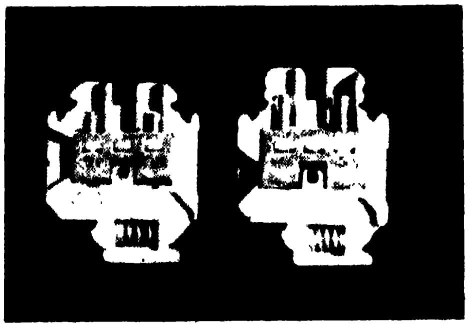


VOLTAGE STABILISERS

Micro Motors Mfg Co offers a wide range of automatic voltage stabilisers for protecting TV sets, air coolers, air-conditioners, refrigerators etc against voltage fluctuations. Single - boost, double - boost, triple - boost and buck, boost models are available with or without voltmeters. Automatic voltage stabilisers for 3-phase supply are also available.
Contact: Micro Motors Mfg Co, 620 Budhwar Peth, Pune 411002.

CLIP ON TERMINALS

Hemvin clip-on terminals, type A, have melamine formaldehide moulded body. They feature high breaking strength and extremely low water absorbing capacity and hence are suitable for tropical environments. Current carrying parts are made up of high quality brass and phosphorous bronze. Surface of all parts are protected by bright nickel plating. Range includes 2, 5 and 10 sq mm.

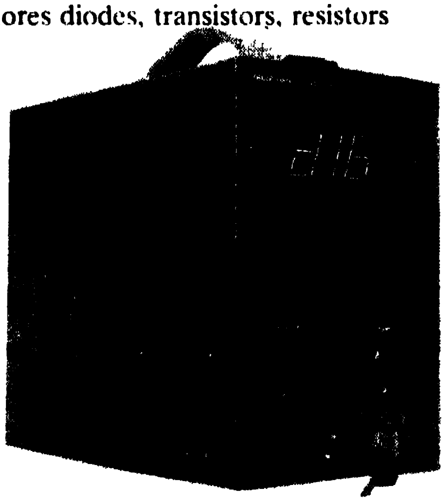


Mounting and shorting accessories are also available.
Contact: Hemvin Industries, 457 GIDC, P.O. Box 747, Vadodara 390010.

DIGITAL CABLE TESTER

Digitronics digital cable tester is most suitable for testing cable ends of which one side is terminated on a cable connector. The connector is to be plugged in on a socket (specified by user) of the cable tester. The instrument probe when touched on the other end of the cable instantly indicates the pin number and confirms the connections.

It is also suitable for prewired sub - assemblies. The voltage level for testing is so adjusted that the circuit ignores diodes, transistors, resistors above 100 ohm connected between two cable ends.



If a cable under test is connected to another cable through resistance less than 100 ohms, the other cable pin will also be indicated in sequence. The number of digits and sockets are to be specified by the users.
Contact: Digitronics, 1251/5 Prabhat Nagar, Opp. Film Institute, Pune 411004.

POWER INVERTERS

Vensons 'Carry-Power' general - purpose inverters are designed to provide square wave 50Hz output of 200-240 volts for up to 500 VA from 6, 12 and 24V batteries. Rugged in construction, these inverters are designed for field use.

The inverters are housed in sturdy

sheet metal cabinets. The design employs a power frequency transformer, the secondary of which in series with an inductance will deliver the rated output to the connected load. The primary of the transformer is driven by a set of parallel bridge - connected silicon power transistors. A separate driver unit will drive these power transistors, ensuring reliable operation.

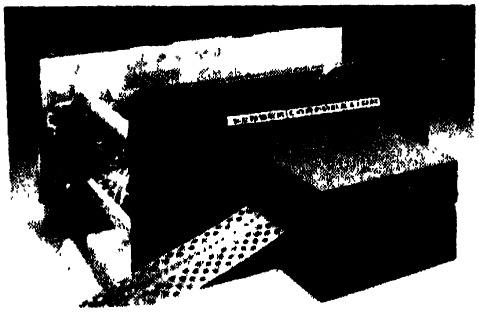
Their frequency stability is better than ± 2Hz at nominal input voltage. Reverse polarity indication of the input power, 'Inverter On' indicating lamp, input and output fuses are provided on all inverters. Input and output meters can be provided if required.

Contact: Venson Electric Company, 1/2 V Block, Rajajinagar, Bangalore 560010.

PUNCHED TAPE READERS

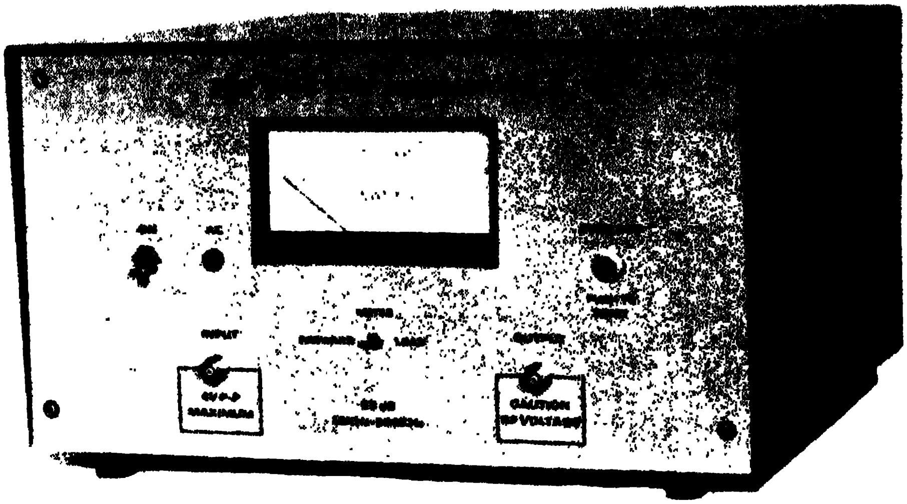
EECO's new 2001-2 step/mate tape reader is now available for immediate delivery from stock. The reader was designed for microprocessor software development, PROM programming, phototypesetting and machine control applications.

The reader's specifications include punched tape reading at 150 cps, complete tape drive electronics and output/handshake signals that are TTL compatible.



The extra wide-opening read head is designed to reduce read errors due to out - of - tolerance and skewed tapes. It is constructed of high wear resistant materials and will not build up error causing static electricity. The bidirectional read head is self - cleaning and features a broad shouldered sprocket for gentle tape handling.

Contact: Echbee Corporation, 38 Cawasji Patel Street, Bombay 400001.



POWER AMPLIFIER

The all solidstate Model 1040L power amplifier operates over a frequency range of 10 kHz to 500 kHz providing over 400 watts of output power. This hybrid coupled unit is designed for operation where high reliability is a prime requirement.

The nominal flat gain of 55dB will permit this amplifier to be driven to full output from any signal generator, function generator or oscillator capable of up to 1.5 volts P-P output into 50 ohms. The unit can operate at reduced power over a frequency range of 7 kHz to 1 MHz.

Any load impedance can be connected to the output without damage, including an open or short circuit condition. It can absorb up to 70 watts of reflected power, before the automatic instantaneous cutout protection circuitry will shut down the unit.

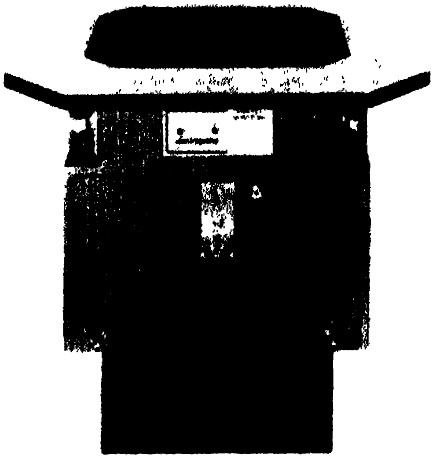
A built-in true average power meter measures both the power leaving the 1040L and the power absorbed by the load. A meter accuracy of better than 3% is provided by a unique computer circuit in the output.

Contact: Trans Marketing Pvt Ltd, Sterling Centre, 16/2 Dr Annie Besant Road, Bombay 400018

VIDEO GAMES MACHINE

A coin-operated, electronic video machine has been developed to give a choice of three games and has optional settings for one to four players.

Worldwide, the most popular games are polo, tennis and soccer which usually are played on individual machines. The Australian company, Lectrogame Pty Ltd, has produced a machine which combines all three games. The game of choice is selected by push button; one coin buying a game for one or two players and two coins a doubles game for four players.



The machines have solidstate electronic circuits and monitors which are virtually trouble-free. The logic board is fully soldered and most components are plug-in type to minimise service time. The cabinets are designed for easy service and all parts are freely accessible. The cabinet top is waterproof and shatterproof. The machine features a sealed counter to check the number of coins deposited.

Contact: Lectrogame Pty Ltd, 432 West Botany Street, Rockdale, New South Wales, Australia 2216.

Production of TV Sets

(by Units Approved by the Department of Electronics)

S. No.	Name & Address of the Unit	Approved annual capacity	Production (in numbers)			
			1973	1975	1976	1977
	SMALL/SCALE SECTOR					
1.	Videon, 20/8 Old Market, West Patel Nagar, New Delhi 110008	2,500	—	Nil	18	110
2	D.T. Gandhi, 2/14 East Patel Nagar, New Delhi 110008.	2,500	101	174	67	86
3	Udham Singh Radio Engineers, B-77 C.C. Colony, Opp Rana Pratap Bagh, Delhi 110007.	1,800	—	59	20	N.R.
4.	Eskay Electronics (P) Ltd, C-223 Mayapuri Industrial Area, Phase II New Delhi 110064	7,500	4,046	5,001	10,053	9,364
5	Televox (India) Pvt Ltd, 3/4 Asaf Ali Road, New Delhi 110002	2,500	300	658	623	1,207
6.	Udyog Bharti (P) Ltd, 57-M Connaught Circus, New Delhi 110001	2,500	125	322	368	561
7	Electronic Consortium (P) Ltd, New Delhi.	—	—	Nil	—	N.R.
8.	Radiovision Industries, 48/1 East Patel Nagar, New Delhi 110008	2,500	—	182	174	179
9.	Weston Electroniks Limited, 43A Okhla Industrial Estate, New Delhi 110020.	10,000	5,831	12,727	24,934	43,851
10.	Silvano Electronics, 7/16 Kirti Nagar Industrial Area, New Delhi 110015	2,500	—	399	197	468
11	Jupiter Radios, C-46 Okhla Industrial Estate, Phase II, New Delhi 110020.	7,500	—	1,478	5,388	12,635
12.	Bharat Television Ltd, "Rock Lands", 1-10-63/64 Begumpet, Hyderabad 500016.	10,000	1,841	3,157	5,004	6,680
13.	American Electronics, Plot No. 91, GIDC Industrial Estate, Makarpura, Baroda 390009.	2,500	—	70	58	50
14.	Mac Electronics, 18 Steel Mould Industrial Estate, Nagarvel Hanuman Road, Ahmedabad 380023.	5,000	1,034	Nil	1,860	724
15	Television & Components (P) Ltd, Plot No. 57, GIDC Industrial Township, Naroda, Ahmedabad.	10,000	3,544	6,175	8,668	14,154
16	Hayat & Company	—	—	Nil	—	N.R.
17	Gujarat Industrial & Investment Corporation Ltd, Natraj Chambers, Ashram Road, Ahmedabad.	5,000		Nil	Nil	Nil
18.	Orient Electronics, Exchange Place, Maulana Azad Road, Srinagar	2,500		Nil	N.R.	479
19	Acharya Electronics, Ghat Road, Nagpur 440002.	2,500	175	253	141	805
20.	Polestar Electronics Pvt Ltd, Govt. Industrial Area, Kandivili (W) Bombay 400067.	10,000	10,089	6,131	4,995	5,485 (Not for full year)
21	International Electronics, 61-63 Sutar Chawl, Bombay 400003.	2,500		301	N.R.	128
22	Industrial Electronics, 9 Varsha, 69-B Napean Sea Raod, Bombay 400006.	—		Nil	—	Nil
23.	Sudarshan Electronics Corp., 26 Jolly Maker Chamber I, Nariman Point, Bombay 400021.	5,000		852	1,377	1,921
24.	Bombay Television (P) Ltd, Bombay.	—	384	15	—	N.R.
25	Amber Television Pvt. Ltd., B20/21 Nandjyot Industrial Estate, Andheri-Kurla Road, Bombay 400072.	2,500		2,040	2,615	3,955
26	Kartari Electronics, 40/41 Vellard View, Tardeo Main Road, Bombay 400034	2,500		N.R.	293	176 (10 months)
	Vidharba Television, Ghat Road, Nagpur.	2,500		Nil	Nil	Nil
28	Mandelia Electronics (P) Ltd, Century Bhavan, Dr Annie Besant Road, Worli, Bombay 400025.	2,500		N.R.	—	N.R.
29.	Velwyn Television Industries, 173 Lloyds Road. Madras	2,500		364	277	136 (10 months)
30	Hi-beam Electronics, 10 Second Crescent Park Road, Gandhi Nagar, Madras.	2,500		N.R.	N.R.	198

S. No.	*Name & Address of the Unit*	*Approved annual capacity*	*Production (in numbers)* *1973*	*1975*	*1976*	*1977*
31.	B.L.R.S., C-6 Industrial Estate, Madurai 625007	2,500	312	265	N.R	N R.
32.	Krish Electronics (P) Ltd, 24 Sundereshwarar Street, Mylapur, Madras.	2,500	—	N.R	N.R	N.R.
33.	Belltek Electronics (P) Ltd, A-80 Naraina Industrial Area, Phase I, New Delhi 110028.	5,000	732	2,506	4,815	8,726
34.	Dilwali Traders, 11-B Regal Buildings, Parliament Street, New Delhi 110001.	2,500	—	Nil	—	N.R.
35.	Modern Electronics, G.T. Road, Vanaspati Building, Kundli, Sonepat, Haryana.	2,500	—	564	1,573	1,986
36.	Crystal Electronics, D-1 Industrial Estate, Partapur, Meerut	2,500	—	18	88	295
37.	Video Electronics (P) Ltd, Plot No 8/2, Site No. 4, Industrial Area, Sahibabad, Ghaziabad	5,000	396	1,499	2,710	6,233
38	U.P. Paravatia Vikas Nigam Ltd, Civil Sectt Bldg, Nainital	5,000	—	40	37	N R
39	Videosonic Electronics, 1514 Behind Bhagirath Place, Chandni Chowk, Delhi 110006	2,500	—	Nil	N.R	N.R
40.	Sona Electronics, 9 Navyug Market, Ghaziabad.	2,500	—	412	978	1,236
41	Ultravision (P) Ltd, 111/98A-(7) Ashok Nagar, Kanpur	2,500	990	392	248	N R
42	Television & Electronics Associates (P) Ltd, J/12, 16-A Rankatora Road, Varanasi	2,500	—	Nil	N R.	N R
43	Jyoti Electronics, 47 Graham's Land, Calcutta 700040	2,500	—	79	398	N R.
44.	Radcon Electronics (P) Ltd, 3-Benoy Balal Dinesh Bagh (East), Calcutta.	2,500	—	75	N R	N R
45	Binay Electricals & Appliances Pvt Ltd, 34/1P Ballygunge Circular Road, P B. No 10226, Calcutta	2,500	—	14	N.R.	7
46	Sonodyne Television Pvt Ltd, 7 Sourin Roy Street, Calcutta 700034.	2,500	—	Nil	448	2,058
47.	Basilk Instruments (P) Ltd, 34 Ganesh Chandra Avenue, Calcutta.	2,500	—	10	N.R.	N.R
48	Telerama (India) Ltd, 11 Sooterkin Street, Calcutta 700072	7,500	—	2,553	3,782	6,548
49	Satellite Electronics Industries (P) Ltd, 6949 Sudhi Sakha Bhawan, Delhi 110007.	2,500	—	93	N.R.	Stopped production
50	Television Combine, Bottling Co Compound, Jhotwara, Jaipur 302012.	2,500	132	183	N.R.	N.R
51	Nabco Electronics (P) Ltd, Cinema Road, Opp Raikhy Cinema, Ludhiana	2,500	268	203	304	N R
52.	Grewal Radio Co. (P) Ltd, C-39 Focal Point, II Phase, Dhandari Kalan, Ludhiana	2,500	—	111	163	N R
53	Indian Television Industries, 187 Shakti Nagar, Jullundur	2,500	—	Nil	Nil	Nil
54	Punjstar Standard Electronics Ltd, 303 Sector 10-B, Chandigarh	7,500	802	2,001	2,300	6,498
55.	Jayoree Electronics, B-117 Industrial Estate, Peenya, Bangalore.	2,500	—	117	85	N R
56	Orissa Small Industrial Corporation Ltd, Banabali Stadium, Cuttack, Orissa.	10,000	—	1,237	844	4,103
57	Himachal Pradesh Mineral & Industrial Development Corporation, Television Factory, Chambaghat Industrial Estate, Solan.	5,000	—	189	917	2,005
58	Bihar State Industrial Development Corporation Ltd, 1 Bandar Bagicha, Patna.	5,000	—	Nil	Nil	Nil
59	Televista Electronics Pvt Ltd, 239 Okhla Industrial Estate, New Delhi 110020.	15,000	15,483	7,984	14,237	29,137
60.	Amar Electronics Pvt Ltd, C-1 Community Centre, Opp I.I T Gate, New Delhi 110016.	2,500	—	N R	850	N.R
61.	Goa Electronics Ltd, Economic Development Corporation of Goa, Daman & Diu Ltd, Shri Saraswati Mandir Bldg, II Floor, 18th June Road, P.B. No. 316, Panaji, Goa.	5,000	—	N.R	Not in production	N R
	LARGE SCALE SECTOR					
62.	J.K. Electronics, Kamala Tower, Kanpur.	20,000	7,914	5,911	6,748	N.R.
63.	Telerad (P) Ltd, Saki Vihar Road, Chandivli, Bombay 400072	20,000	10,557	8,278	7,676	17,484
64.	John Prasad, Madras.	—	—	Nil	—	N R

S. No	*Name & Address of the Unit*	*Approved annual capacity*	*Production (in numbers)*			
			1973	*1975*	*1976*	*1977*
65	Electronics Corporation of India Limited, Industrial Development Area, Cherlapalli, Hyderabad 500762	20,000	9,036	17,700	17,719	16,513
66.	Radio & Electricals Mfg Co Ltd, P.B No. 2606, Mysore Road, Bangalore 560026	5,000	308	210	N.R.	100
67	Rajasthan State Industrial Development Corporation Ltd. 100 Jawaharlal Nehru Marg, Jaipur.	5,000	—	Nil	106	Nil
•68	Kerala State Industrial Development Corporation Ltd, Keltron House, Vellayambalam, Trivandrum 695001.	—	—	2,971	3,340	2,954
69	Harvana State Industrial Development Corporation Ltd, SCO 4-5, Sector 17-A, P B No 22, Chandigarh 160017.	5,000	—	650	897	N.R.
70	Dynavision Limited, 1 Padmanabha Nagar, Guindy Road, Madras 600020.	10,000	—	85	4,308	10,462
71	U P Electronics Corporation Ltd, 4 Prag Narain Road, Lucknow 226001	5,000	—	200	963	2,825

N R —Production figures not received by the Department of Electronics

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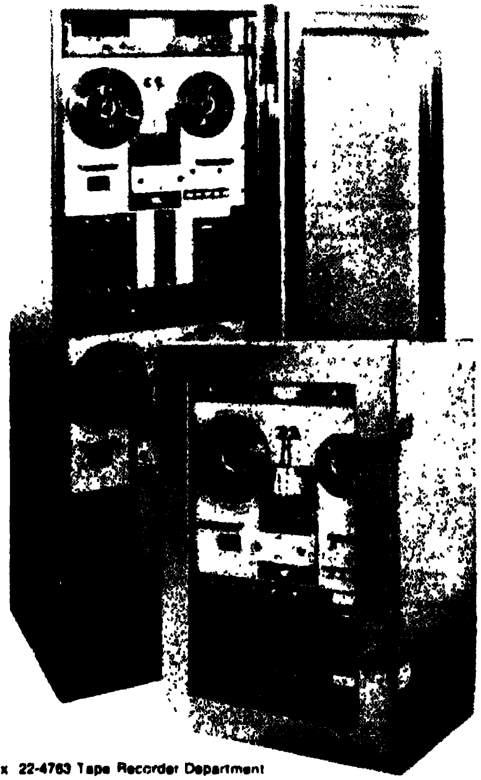

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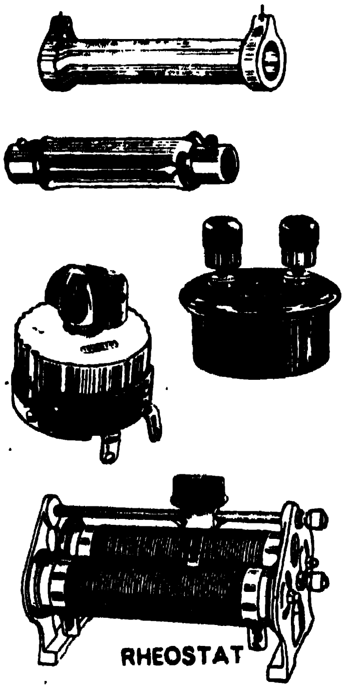

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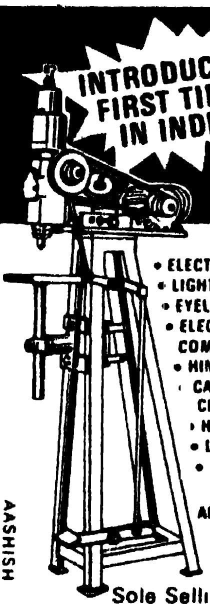

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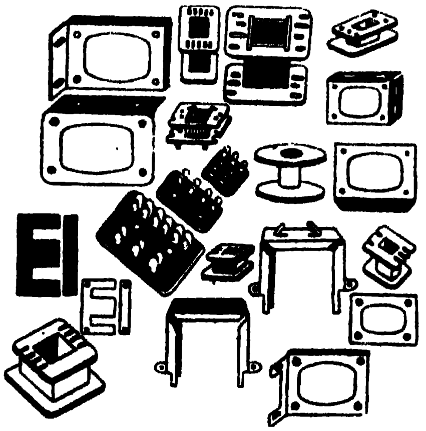

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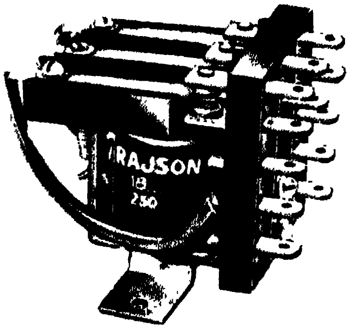

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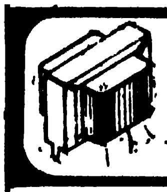

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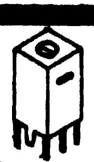

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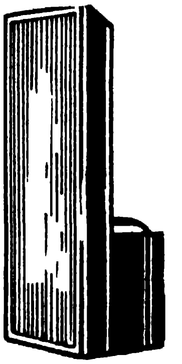

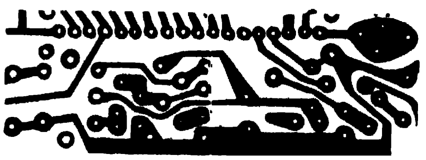

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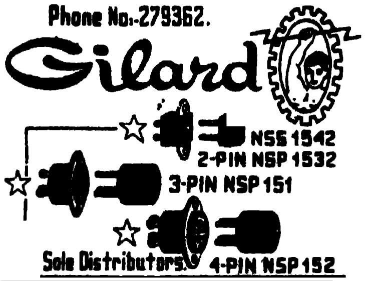

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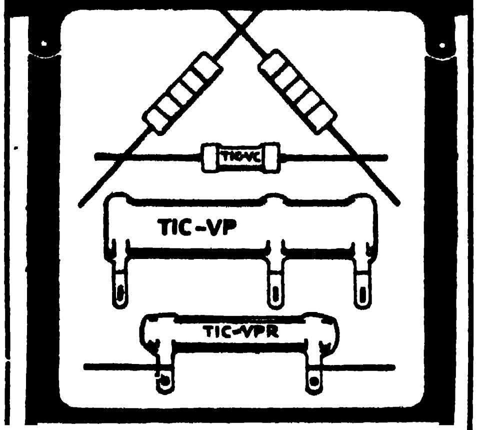

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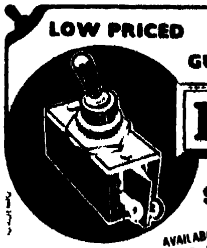

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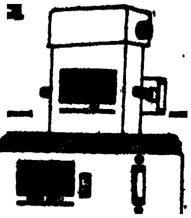

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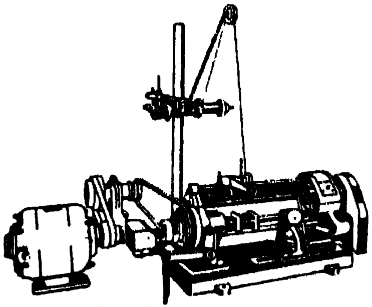

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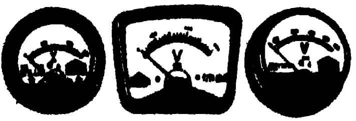

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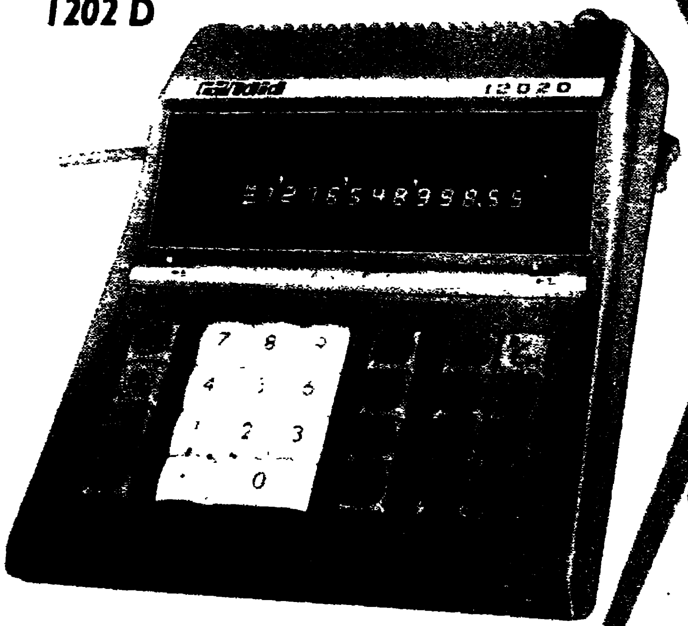

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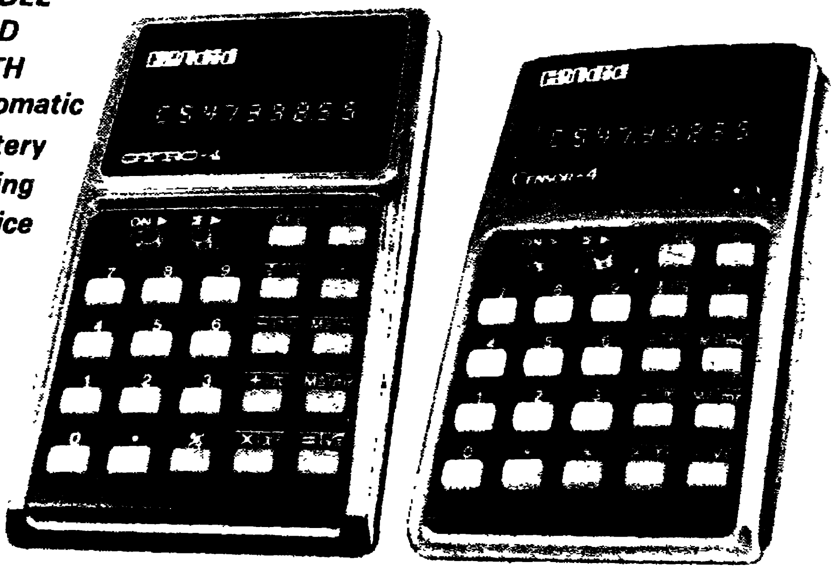

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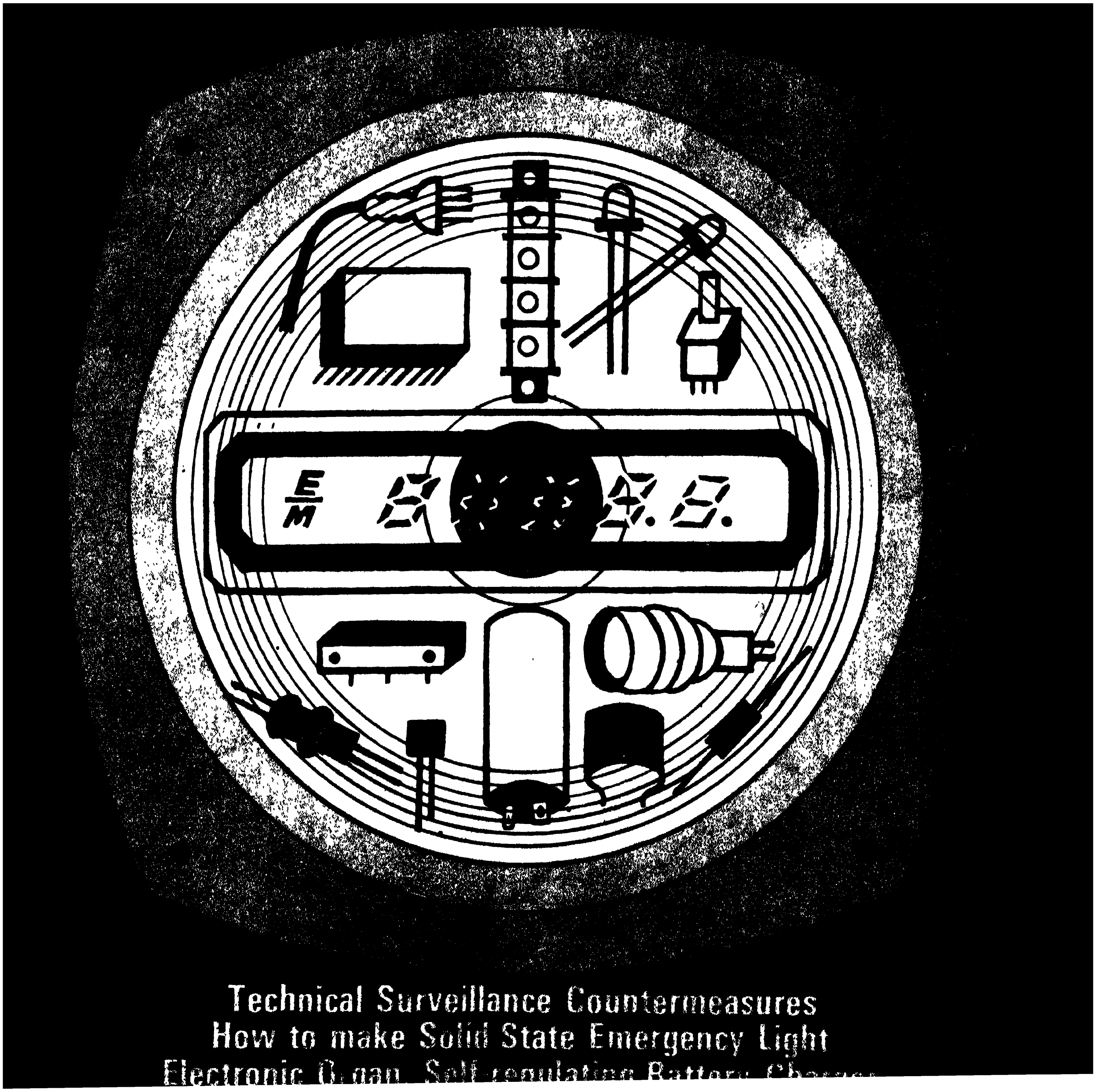

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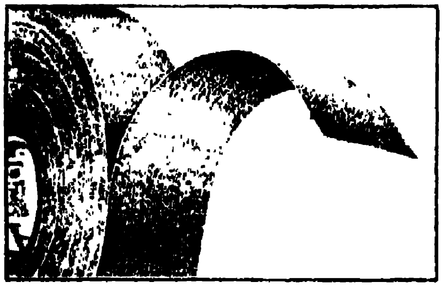

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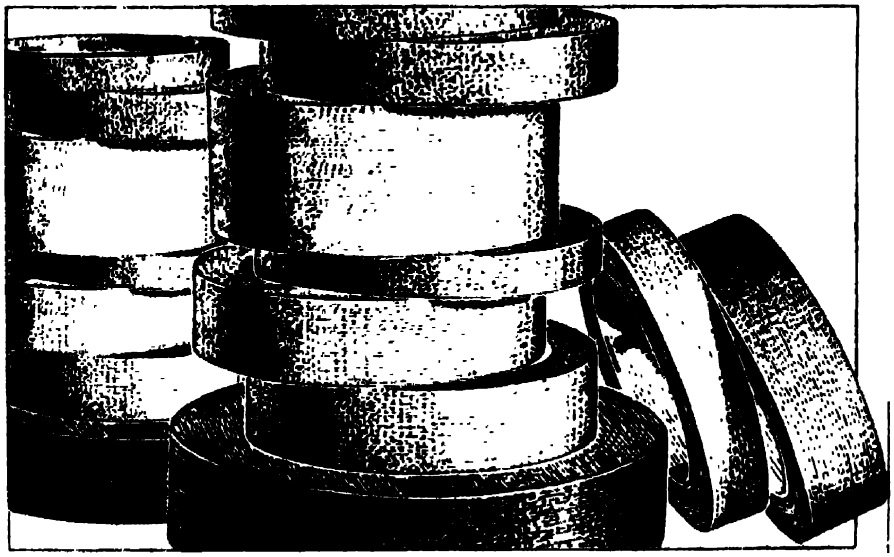

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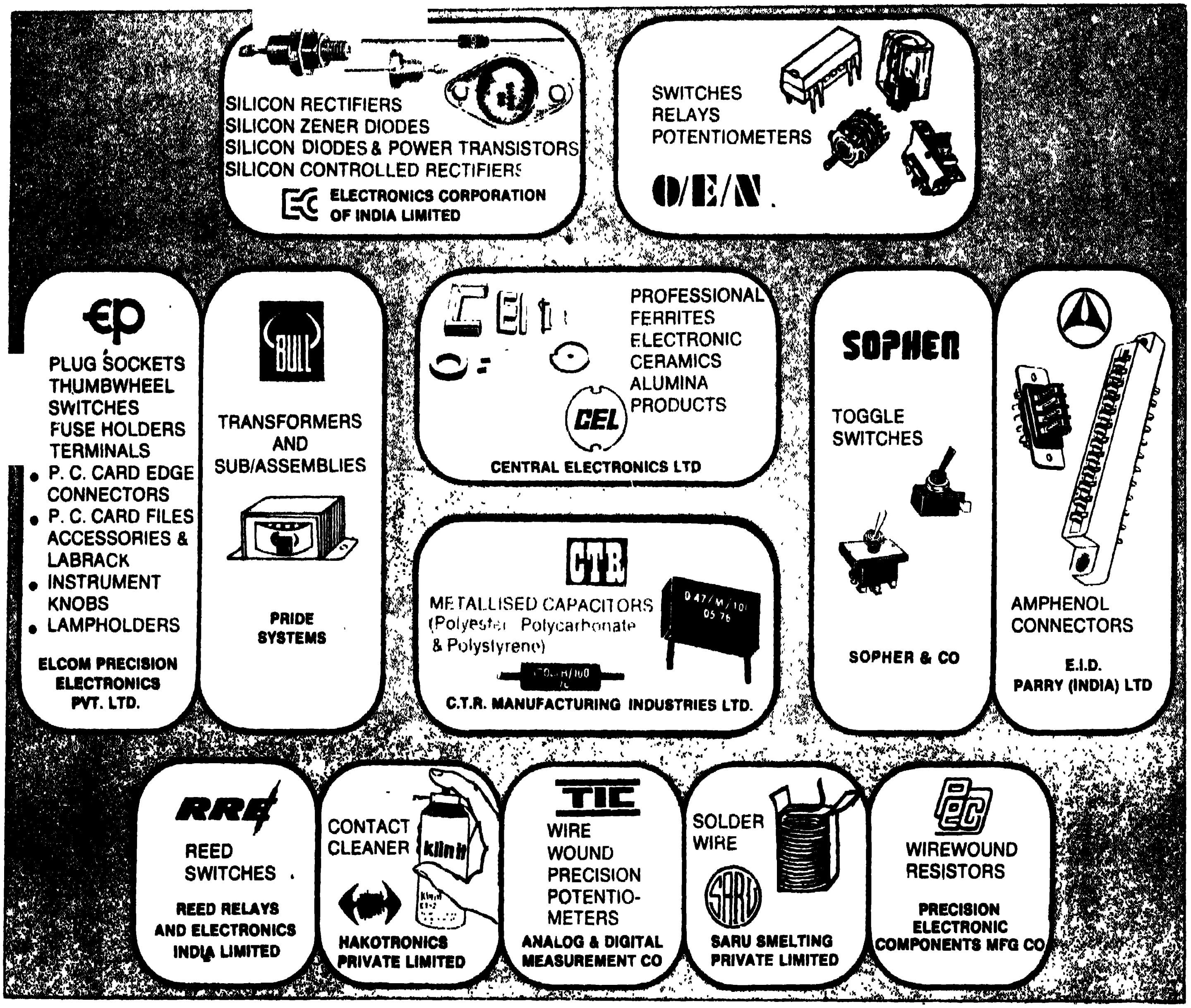

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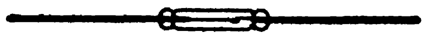

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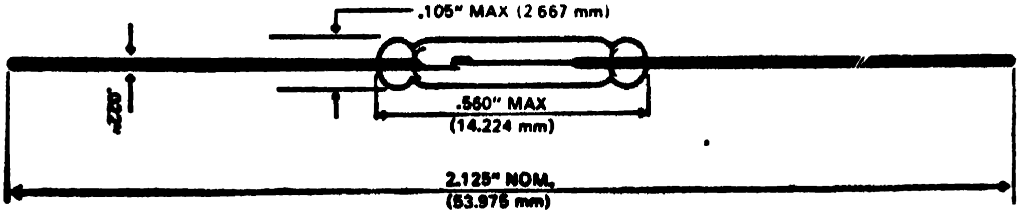

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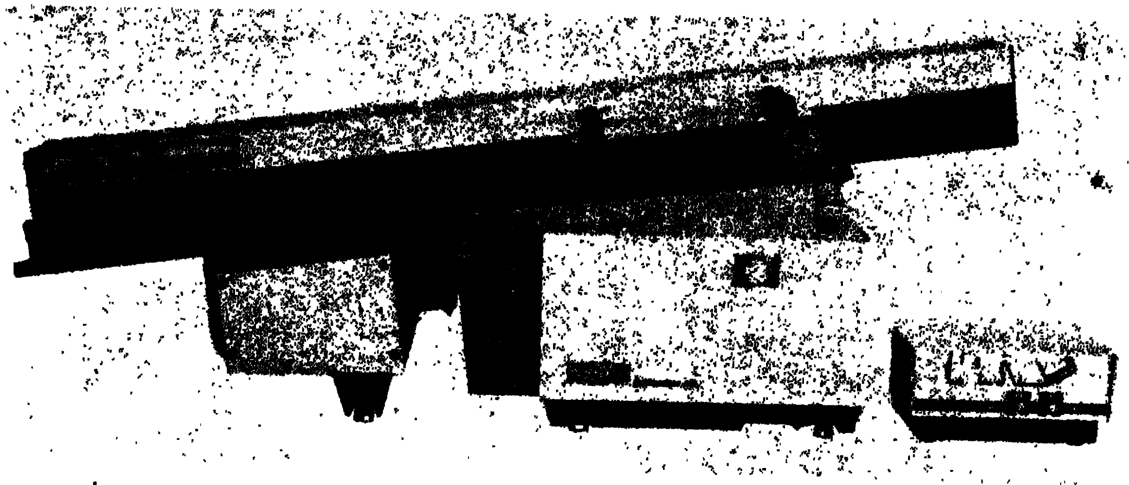

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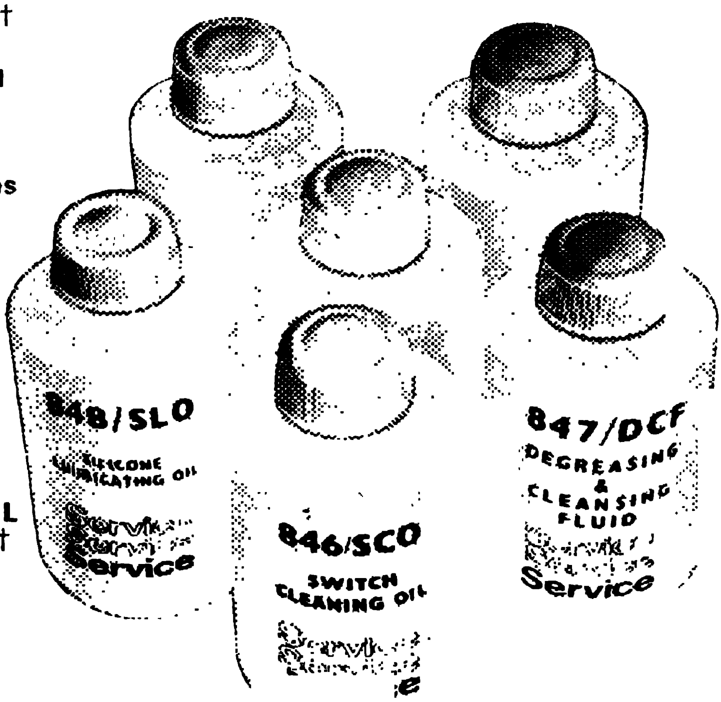

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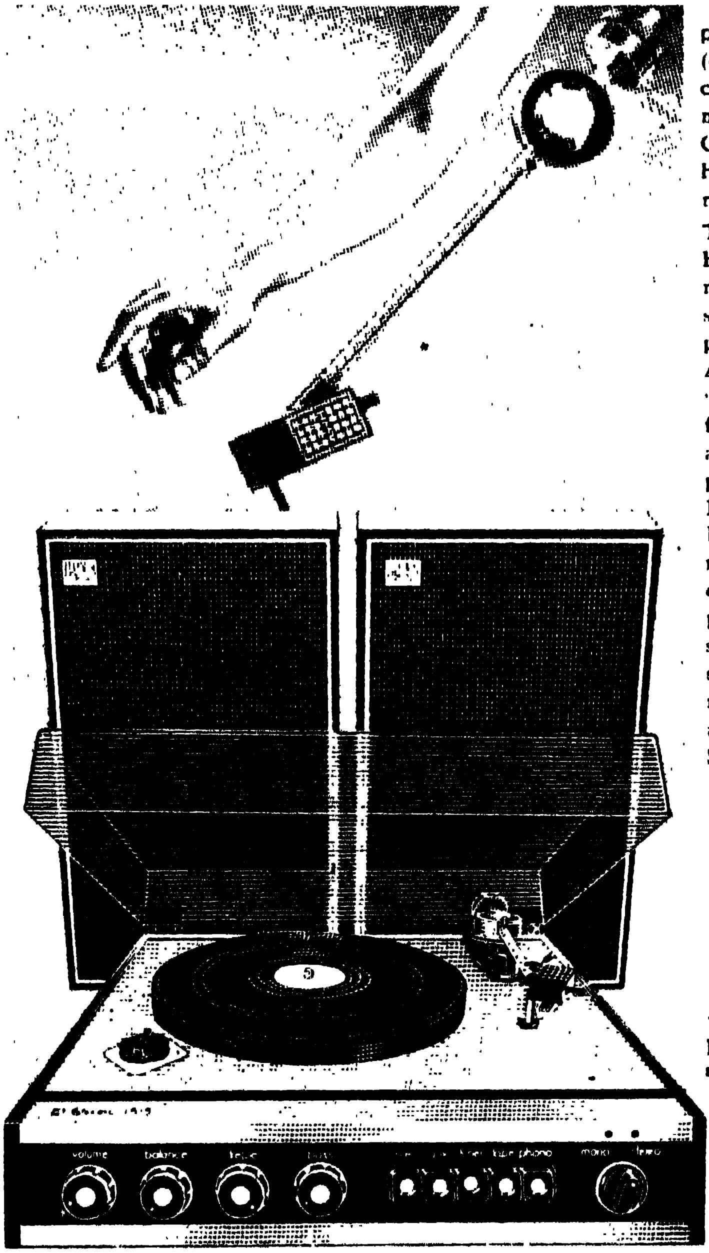

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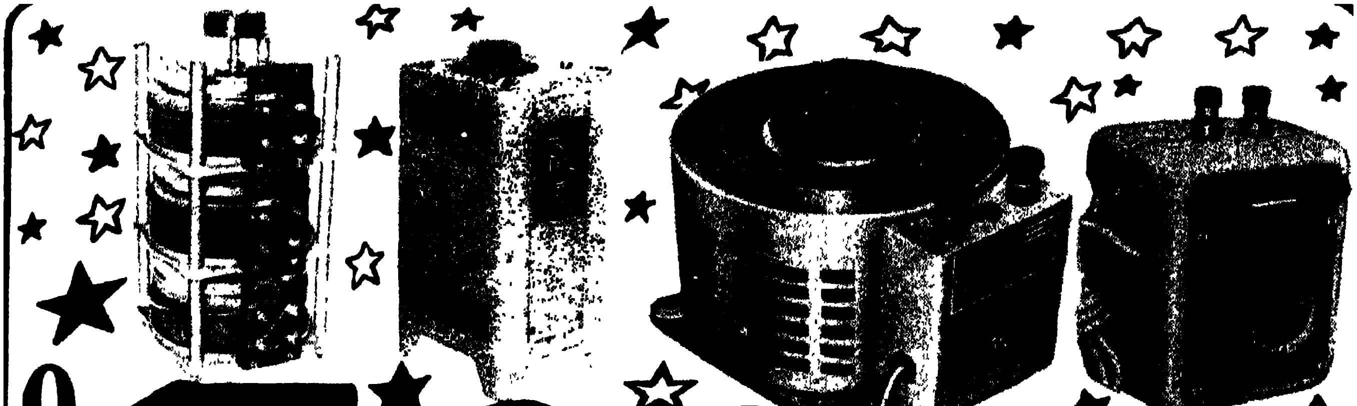

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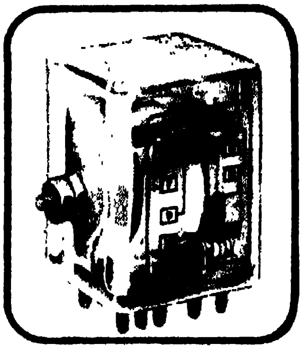

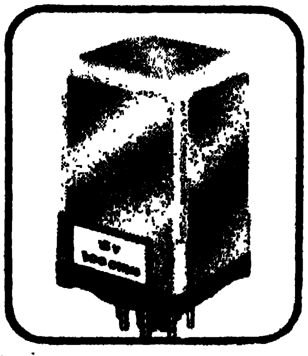

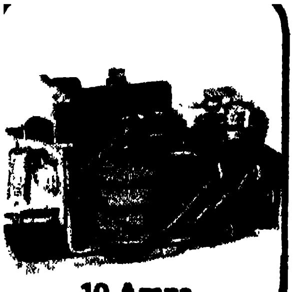

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April — Electronic Watches & Clocks

May — Telecommunications in India

June — Electronic Calculators

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EDITORIAL

BUDGET: A BLOW TO THE ELECTRONICS INDUSTRY

The central budget for 1979-80 presented to Parliament on February 28, 1979, by the deputy prime minister and finance minister, Mr Charan Singh, is disappointing in so far as the electronics industry—particularly the consumer electronics sector—is concerned.

The excise duty on TV sets, radio receivers and radiograms has been enhanced, irrespective of the price or the size of the set.

The excise duty has been increased from five per cent to 15 per cent in respect of the following:

(a) single channel TV set of screen size 36 cms and of value not exceeding Rs 1400 per set,

(b) multi-channel TV set of screen size 36 cms and of value not exceeding Rs 1550 per set,

(c) single channel TV set of screen size exceeding 36 cms and of value not exceeding Rs 1600, and

(d) multi-channel TV set of screen size exceeding 36 cms and of a value not exceeding Rs 1750 per set.

In the case of TV sets not covered by the above four categories, the excise duty has been raised from 20 per cent to 30 per cent. For combinations of TV sets and radios, the excise duty has been rasied from 25 per cent to 30 per cent.

For high-cost radios manufactured in the organised sector, the excise duty has been increased from 30 per cent to 35 per cent. This applies particularly to sets of three bands and of a value exceeding Rs 250 per set, and to sets of four bands. For sets of five bands and above, the excise duty has been raised from 35 per cent to 40 per cent.

However, the radio sets of one or two bands will continue to be subjected to an excise duty of 15 per cent, without any increase. Similarly, the excise duty of 25 per cent on radio sets of three bands and of a value not exceeding Rs 250 per set will remain unchanged.

Special consideration has been shown to small-scale units manufacturing radio sets; in their case, the excise duty has been lowered by 15 per cent *ad valorem*. Also, radios including transistor sets of value not exceeding Rs 165 per set will continue to be exempted if the sets are manufactured in a small industrial unit fulfilling certain specific conditions.

The total incidence of these enhanced levies in a full year will be about Rs 48.6 million.

In the case of tape recorders of a value not exceeding Rs 500 each, the excise duty will remain unchanged at 25 per cent. However, for tape recorders of a value exceeding Rs 500 each, the excise duty will move up from 30 per cent to 40 per cent. In a full year, the yield of excise duty will be two million rupees.

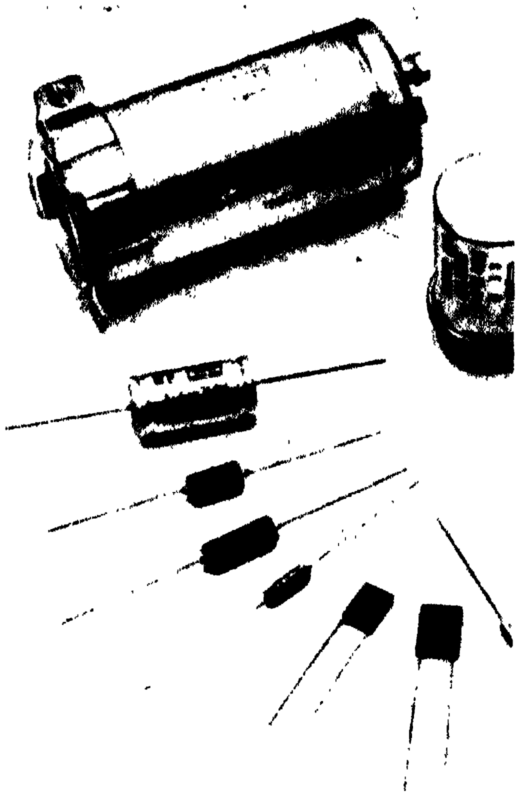
Gramophones, record players, record playing decks, or record-changer decks, have been subjected to enhanced excise duty, fetching a total revenue in a full year at seven million rupees.

Even computers have not been spared; in their case, the excise duty has been increased from 15 per cent to 25 per cent. The finance minister has treated computers also as a luxury. Or is it that he wants the clock to be put back in this country so as to undo whatever has already been achieved in the field of science and technology.

Recently, Prime Minister Morarji Desai stated that his government is not anti-science. Since he heads the Department of Atomic Energy, the Department of Space Research and the Department of Electronics, one felt that he really meant what he said. The latest budget has, however, indicated that Mr Morarji Desai has now a finance minister who has nothing but contempt for science and technology in general and for electronics in particular. In his zeal to help the peasant, he has gone out of his way to hurt the consumer electronics industry particularly.

This has made Prof. Nag's job very difficult. It had been an uphill task for Prof. Menon to educate the bureaucrats in the Ministry of Finance when Mrs Gandhi had under her charge the Department of Electronics (DOE) and the Electronics Commission (EC). Now, under Mr Morarji Desai's charge of the DOE and the EC, the task of communicating with the Ministry of Finance will be well nigh impossible.

The electronics industry in the country is stunned by the new imposts. Its spokesmen are searching for words to express their resentment. For once, the DOE, the EC and the electronics industry are agreed that the budget has dealt a severe blow to this sophisticated industry. They will have to sit together and evolve a strategy for educating Mr Charan Singh and his advisers. The prime minister will also have to extend a helping hand. This industry, which has been nurtured carefully during the past decade, should not be allowed to languish simply because the Ministry of Finance is now headed by a man who has the good of only farmers at heart—as if those who are not farmers are not the citizens of this country.



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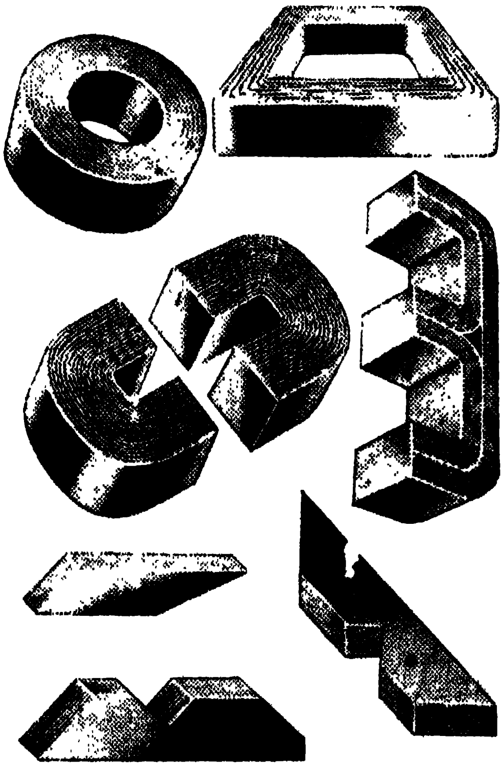

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WHAT'S NEW

In India ...

Computers from the Common Market Are Coming

Representatives of nearly 25 Common Market electronics companies specialising in computer hardware will arrive in this country on March 17, 1979. They will visit Bombay, Bangalore, Hyderabad, Madras, Calcutta and New Delhi.

There are immense possibilities of exporting computer software from this country. At present, the annual export of software is hardly worth Rs 20 million. Korea and Taiwan have already taken rapid strides in this direction. Their annual export of software is rated to be around Rs 1200 million each.

The representatives of the electronics companies from the Common Market countries will seek Indian partners for the export of software, besides entering into arrangements for the manufacture of products with a value added to the tune of 30 per cent or more for the export market. Some of them will also examine the possibility of exporting hardware to Asian markets—hardware manufactured in collaboration with Indian companies.

DOE Regional Offices Undergoing Expansion

While addressing a convention on the Development of the Electronics Industry in the Eastern Region, Prof. B. Nag, secretary, Department of Electronics (DOE), disclosed recently at Calcutta that the regional offices of this department at Calcutta, Bombay and Madras are being expanded to provide better services to electronics units. The expansion of the offices at Bangalore, Hyderabad and Kanpur will be taken up later.

According to Prof. Nag, a national institute will also be set up in the near future to undertake research work and to supply technology to the electronics industry. This institute will work on the lines of the Bhabha Atomic Research Centre and the Indian Space Research Institute.

To improve the state of the electronics industry in the eastern states, Prof. Nag suggested that an institute for training in electronics be set up jointly by the states. He assured the states that the government would provide all help in the selection of the right kind of personnel and would even arrange international aid, if required

Prof. Nag also pointed out that to accelerate the rate of growth of the electronics industry, a large number of components units would have to be set up. He further said that the competitiveness of the industry depended upon the efficiency of the units manufacturing components.

New TV Relay Stations to Come Up

Besides television transmitting stations at Trivandrum, Bangalore and Ahmedabad, nine relay transmitters are proposed to be added to the TV network during the plan period 1978-83. These relay stations will be located at Vijayawada, Jammu, Cuttack, Ajmer, Madurai, Varanasi, Asansol, Murshidabad and Panaji.

This information was given by Mr L. K. Advani, central minister for Information and Broadcasting, on February 10, to the consultative committee members of Parliament attached to his ministry

Mr Advani said that the TV centre at Jullundur which was scheduled to commence transmission on April 13 has been delayed; its transmitter having a range of 80 km is now expected to be ready by September this year However, alternative arrangements have been made to instal a one kW transmitter with a temporary tower and a small studio by April this year

Electronic Telephone Exchanges on the Anvil

A master plan for the introduction of electronic exchanges in the telephone system and the manufacture of such exchanges indigenously is being finalised by the government of India.

The factory for the electronic type of equipment using a design developed abroad or within the country will be set up by 1985-86.

A small exchange based on the local design is now under trial in New Delhi. Ours is perhaps the only developing country which has been able to come to the stage of its own prototype model of an electronic switching system.

An inter-departmental committee consisting of representatives of the Posts and Telegraphs Department, Department of Electronics, Planning Commission and the Indian Telephone Industries Ltd has been set up to finalise the system to be imported for trial in metropolitan cities.

The committee will also recommend before the end of the current year whether collaboration arrangements of some components and sub-assemblies can be finalised before a final decision is taken in 1983 regarding the system to be manufactured in the country.

Bill on Autonomy in Budget Session

The central minister of state for

Information and Broadcasting, Mr Jagbir Singh, is reported to have said on February 11 at Calcutta that the proposed bill for making A I R and TV autonomous might be placed in the Parliament during the Budget session. The cabinet sub-committee had already finalised its report in this regard, he added.

According to Mr Singh, the government had decided to render financial assistance to the proposed corporation, but it did not mean that the government would have any direct or indirect control over its day-to-day functioning.

Mr Singh further said that the proposed bill had provided for more freedom to be enjoyed by the corporation, but "more freedom means more responsibility."

Electronics to Boost Coal Mining

According to a report published in the *Economic Times*, the Central Mine Planning and Design Institute (CMPDI), Ranchi, will soon have a cell for planning and systems engineering of the coal mining industry. Electronics will be introduced in this industry in a big way so as to modernise the coal industry and step up its production.

A study group has prepared a feasibility report which envisages total cost of the order of Rs 4.58 million over a three-year period. The participants in the project will be the Electronics Commission, the Department of Coal, and the Department of Mines.

And Abroad ...

Versatile Multilayer Capacitors Now Available

As a result of new techniques it is now also possible to prepare relatively thin layers from ceramic dielectric materials, and from these layers to build up capacitors with mechanical and electrical characteristics meeting stringent requirements.

With the two types KDPU (with leads and epoxy resin encapsulation) and KEFQ (chips without encapsulation), Siemens (W. Germany) now supplies a wide spectrum of these multilayer. capacitors for a variety of applications. Depending on the desired temperature response, three materials are available. The capacitance values range from 4.7 pF to 4.7 µF (KDPU) and 1 pF to 1.5 µF (KEFQ).

Typical applications are communications, data processing, industrial electronics and aerospace and automotive engineering.

The rated voltage values, ceramic types and climatic categories of the 'naked' KEFQ types correspond to the KDPU data. The low inherent inductance of these capacitors makes them ideally suitable for HF circuits for use extending into the GHz range.

The versions without epoxy resin encapsulation and leads are intended for direct soldering to film circuits (hybrid circuits). For this purpose, the external dimensions are particularly small.

ITU Holding Seminars in Preparation of WARC

The International Telecommunication Union (ITU), a United Nations agency for telecommunications, is presently arranging seminars in various parts of the world.

The purpose of these seminars is to help developing countries prepare for the World Administrative Radio Conference (WARC) to be held in Geneva from 24th September to 30th November this year. The conference is being held to revise the international 'Radio Regulations' which govern the operation of all kinds of radio services throughout the world.

As the WARC will bring about the first complete revision of the radio regulations since 1959, and since the regulations laid down at this conference are likely to remain in force beyond the year 2000, the conference is of utmost importance to all countries for planning their future radiocommunication services.

Moreover, as delegates to this conference are required to be adequately trained for their tasks, both to facilitate the work of the conference and to ensure best results. For these reasons, the ITU has decided to assist developing countries in their preparation for the WARC 1979 by holding workshop-type seminars for each one of the three regions, namely African and Arab countries, the Americas, and countries in Asia and the Pacific.

The first seminar was held in Nairobi in the third and fourth week of February. The second seminar will be held in Panama from the 12th to the 23rd of March, while the third seminar is scheduled to be held in Sydney from 29th March to 10th April, this year.

These seminars will provide an understanding of various technical parameters that relate to the future development of terrestrial and space radiocommunication services and their co-existence with a view to an optimum utilisation of the radio spectrum.

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Plastics, wood, glass, metals,	J 1020 (two pack)	Brush/Dip	100°C
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ceramics	J 1020 B (one pack)	Screen print	175°C
	J 1020 C (one pack)	Brush/Dip	175°C
Phenolic/Glass epoxy boards, glass, metals, ceramics	J 1024	Screen print	150°C max.
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Highly conductive, readily solderable, these preparations are designed for use as capacitor electrodes and in resistor-capacitor networks on ceramic bodies. After firing, with no further treatment, they are solderable by soft solders at 210 to 215°C. Suggested uses: mica capacitor electrodes, ceramic-disc capacitors, feed-through capacitors, tubular capacitors, resistor-capacitor networks, printed circuitry, transducers and soft glass metallizing.

Mica	J 1030	Screen print	590°C
	J 1030 A	Screen print	590°C
	J 1030 B	Brush	590°C
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CIRCUIT

The instrument circuitry is using solid state devices (mostly silicon) mounted on specially designed printed circuit boards.

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Though people with previous Harmonium or Piano knowledge will hardly require any practice to play, others can also pick up with a little effort. For this purpose a booklet with a few popular songs with notations is also being provided with the instrument.

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A user's manual with complete circuit diagram is enclosed with the instrument. Spare parts required could be ordered out for replacements including that of key contact board.

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LETTER

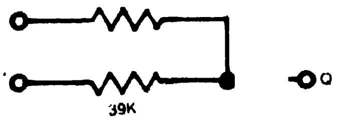
TRANSISTOR 'AND' GATE CIRCUIT

Going through your September 1978 issue, I found that S. Ashok's 'Transistor AND Gate Circuit' wouldn't really work fully (i.e. would not satisfy fully AND logic's 'truth table'.)

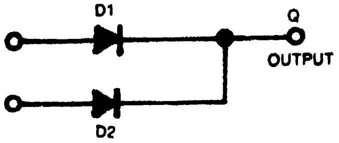
When X = 0 and Y = 'don't care', T2 is off. Then, Ashok's circuit can be reduced to the following, as far as the output is concerned:

Now, for X = 0 and Y = ø ('don't care'), output Q should be '0'. And without load connected to Q, output does give '0' output.
But as soon as a TTL input is connected to the output, the 39k sinks TTL's input current causing Q to go to a high as there is considerable voltage drop across the 39k resistor.

Ashok's circuit can be used where not much current sinking is required. But then here's a simpler one for such a case:



Where more current-sinking is required, the following circuit may be used:



where D1 and D2 are preferably germanium diodes. A suitable resistor may be connected from output to Vcc for current sourcing, but going into that discussion may be out of the way here.

KUMAR TALREJA
Pondicherry

Mr S. Ashoka Krishna Bhat clarifies:
I am thankful to Mr Talreja for his comments on my design 'Transistor AND Gate Works Without Power Supply.'

I would like to point out that the resistor values were given for 12V pulse height operation. The circuit was tested with CMOS IC CD4012PC (Dual 4-input NAND gate) and worked satisfactorily.

I have mentioned clearly in my design idea that the values of the resistors are to be changed with the type of circuit supplying the pulses. So, if TTL gates are to be used then, as Mr Talreja has rightly pointed out, when a TTL input is connected at the output without changing the 39k resistor, it will make Q high due to the sinking current through 39k resistor. If the 39k resistor is replaced by a 500-ohm resistor, the circuit will work satisfactorily with TTL gates.

MISTAKES IN THE CASSETTE TAPE RECORDER CIRCUIT

I am a subscriber of EFY and was pleased to see the circuit of the cassette tape recorder in your Annual Number 1979.

On comparing the schematic diagram with the components layout sketch, I found some major mistakes which are listed below·

1. The 'earth' line is positive; so signs of all capacitors shown in the schematic diagram should be changed.
2. Point K on the PCB must be externally joined to the point near the positive terminal of capacitor C20 to make that line positive earth.
3. Points E and F on the PCB must be interchanged.
4. Points A and B on the PCB must be interchanged.
5. Resistors R18 and R21 on the PCB should be interchanged.
6. The negative terminal of capacitor C20 must be directly joined with point 17 of the switch and not to point 18, as shown in the schematic diagram.
7. From the PCB we could see that the lower ends of the oscillator coil L1 and capacitor C24 should be earthed, and must not be connected with R33 or R37, as shown in the schematic diagram.
8. Point 4 of the switch is not shown connected to point F or resistor R34 in the schematic diagram, while it is shown connected thus in the PCB.
9. The point near the positive terminal of capacitor C4 on the printed circuit board is not shown connected anywhere in the circuit. I think it should be connected on the line joining R33, R37 & collector of T9.
10. Please let me know the make of the oscillator coil used in this circuit, if it is readily available in the market.

NILESH PATEL
Ahmedabad

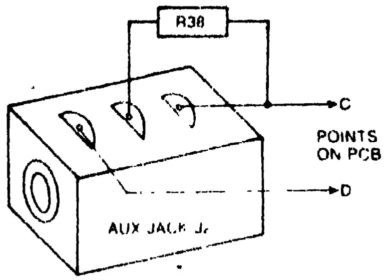
Mr Dhruva Halapeti, the author of the article, clarifies:
I have gone through Mr Nilesh Patel's letter and would like to thank him for pointing out the mistakes that have crept into the article. Most of the mistakes have taken place during the transcription of original diagrams into the final print layout by the draughtsman. I feel sorry that I could not detect these in the proof-copy.

Points 1, 3 to 7 and 8 are correct as suggested by Mr Nilesh Patel.

Point K on the PCB need not be joined to the positive terminal of C20 externally since it will get connected automatically through the deck chassis when the PCB is fitted on the deck. But in case the PCB is to be tested outside the deck, it is necessary to make this external connection.

Circled points near C20, K and between C4 and C3 are the holes to be drilled in the PCB for mounting it onto the deck. A point missed in the article is the connection of the auxillary jack.

The jack should be connected as shown in the following diagram.



It will not be out of place to mention here that ELIN deck manufacturers supply mono tape decks with common negative type motors as well. In this case the following changes are needed in the circuit for satisfactory performance:

(a) Polarity of all electrolytic condensers, diodes and internal battery is to be reversed.

(b) The condenser microphone should be the common-negative type.

(c) Transistors are to be changed to T1-BC149c; T2, T3 and T7-BC148b; T4-BC158b; T5-AC187/01; T6-AC188/01; T8-AC188; and T9-AC187.

With best wishes,

DHRUVA HALAPETI
New Delhi

AN IDEA REGARDING CIRCUIT IDEAS

The circuit ideas published in your journal are extremly good, but I want to give a suggestion.

A circuit idea does not mean that it should always be a designed circuit. It can be a complete circuit or it may only convey the idea, i.e. the principal of operation, to the experimenter so that he may work on the idea according to his needs; the idea may or may not work.

If you want an assurance from the writer that the circuit has been tested and works satisfactorily, then this column of the journal should be called "Tested Circuits" or something of that sort.

Hope you will give some attention to this point.

SUNIL PIPLANI
Delhi

PLEASE CORRECT

In the circuit idea for a 'Transmitter' published in the January 1979 issue of EFY, a couple of mistakes have crept in in the parts list:

1. The capacitor C5 in circuit has been mentioned as C10 in the list.

2. Coils L1 and L2, which are medium-wave antenna coils of the type used in vacuum tube type receivers, have been omitted.

–Managing Editor

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The Secret World of TECHNICAL SURVEILLANCE COUNTERMEASURES

Technical Surveillance Countermeasures is the term used to describe interception or compromise of aural communications such as telephone conversations, or the compromise of visual information such as documents and charts, by technical means. The commonly-used phrase which incorporates the former aspect is 'eavesdropping' or 'bugging.' Technical hardware and skinware employed to carry out this brand of electronic surveillance is termed 'Technical Surveillance Countermeasures.'

The invention of the transistor in 1948 and its availability for use as a radio transmitter has made security against bugging nearly impossible. For the present, our country is largely free from this evil. Perhaps this will continue to be so for some more time, till the law catches up with technology. The fact, however, remains that the scope, both for technical surveillance countermeasures and its counter-countermeasures, is tremendous in India.

The purpose of this article is to describe some popular methods of technical surveillance countermeasure. From the technical angle, the bugging attack can be launched in any one of the following six ways:

1. Mechanical methods
2. Wire and microphone
3. Radio transmitters
4. Carrier current transmitters
5. Visual and optical devices
6. Telephone

A combination of one or more types of 'bugs' can make the task of the counter-countermeasures team more difficult.

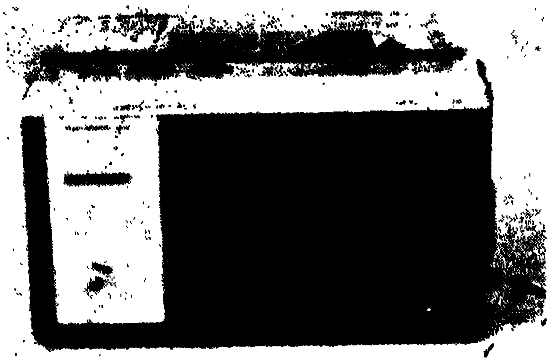

Fig. 1: This pocket cassette tape recorder meant for surveillance measures 115x75x26 mm, but gives a recording time of over four hours on one cassette.

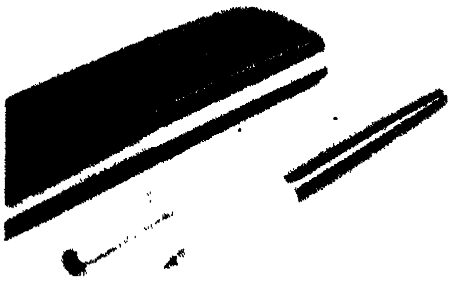

Fig. 2: A VHF (fixed frequency) pen transmitter for short range work. Has a built-in aerial and a sensitive microphone for high quality speech transmission. Uses hearing aid batteries.

Mechanical methods

The technique entails attack by carrying the audio leak equipment into the field by physical means. For recording conversation, miniature tape recorders, stethoscopes or contact microphones can be carried into the area of the attack. A disloyal secretary or staff member seated next door, can carry information to the undesired destination when the level of audio isolation is not sufficient.

In this case, miniaturisation of equipment, although desirable, is not a must. Cassette recorders of cigarette packet size will do the job well enough. To conserve on battery, voice-actuated power supply circuits are used. The cost of mechanical systems may vary from US $30 to US $3,000, depending on the required duration of their operation and the degree of sophistication desired.

Wire and microphone

A microphone's size can vary from a 10cm diameter to a millimetre or less. Therefore, the possibility of hiding a microphone under the carpet, in a vase or even in a wall between two rooms cannot be overlooked.

Directional microphones such as parabolic reflectors and shotgun microphones are both popular and effective. They employ wires or even painted lines (conducting) to carry information to desired distances.

The loudspeaker is a transducer which can also receive energy in the same way as a microphone. Therefore, any unused loudspeaker, even if it is a part of an intercom set, is a potential 'bug.'

The sensitivity of the 'bug' and the distance to which it can carry the intelligence will depend on the degree of amplification carried out *en route* and at the terminal. The distance may vary, in practice, from 30 to 100 metres.

Radio transmitter

In 1952, the US ambassador in USSR was presented a Great Seal' of the USA which he very proudly put up in his office. It remained there for 11 years till one day, when the room was being renovated, it was discovered that the seal had a resonant cavity which worked as an oscillator when RF energy was made to fall on it. The RF energy was modulated by audio conversation in the room and the modulated wave could be received hundreds of metres away. The cavity activation device was a USSR transmitter antenna at a line-of-sight distance from the seal. The discovery of the 'Great Seal' as a 'bug' compromised a major technique used in the field of RF transmission.

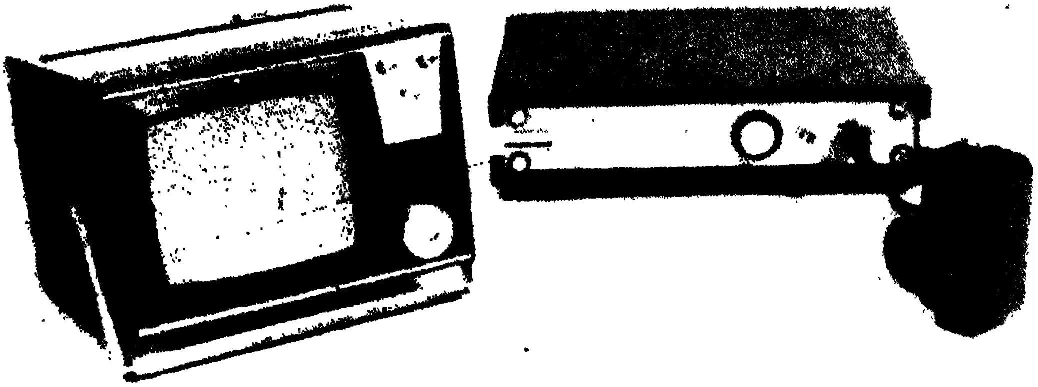

Fig. 3: This portable video surveillance system transmits black- and-white pictures to a control receiver monitor which may be located at a distance of up to 8kms It may be used in an aircraft, helicopter, drone or a car. Power requirements. 12 to 16V DC, 110-120V or 220V 50/60Hz.

Today miniature radio transmitters, 2.5cm square in size, are readily available in the foreign markets. Of course, the transmission distance depends on the power output, but distances ranging from 10 to 500 metres can be realised.

These transmitters can be hidden in shoes, books or furniture. They can also be placed in walls and paintings. However, these devices are comparatively vulnerable as they transmit intelligence in free space which can be picked up on surveillance receivers.

Carrier current transmitter

The basic configuration of the carrier current transmitter is the same as that of the free space transmitter. However, instead of free space transmission, these transmitters use very-low-frequency RF energy which flows along such conductors as water pipes,telephone lines and power lines.

These devices can be planted easily and are very hard to detect. They do not need battery power as they derive power from the source like a parasite.

In this case intelligence cannot be carried for long distances and also cannot cross a 'transformer.' Therefore, these devices are best suited for use in hotels and offices with the agents who carry the information residing nearby.

Visual and optical devices

An optical device views the target through a window or door with the help of powerful binoculars or a telescope. These devices are used to record visual information on wall charts and documents.

Lipreading, a highly complex science, has also been mastered to a high degree of accuracy. Speech can be deciphered by lipreading experts through visual access into a target area

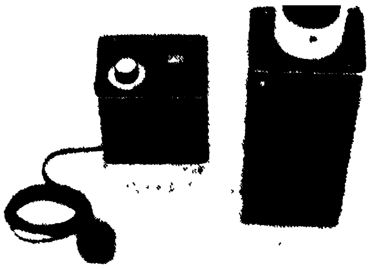

Fig 4: A night vision camera with automatic iris. It has 1/4 moonlight sensitivity and can be used with a TV transmitting system.

Besides, television cameras have been miniaturised to the size of a cigarette case and can be hidden in a ceiling to transmit video and audio information.

Laser beams directed through windows at the target can be modulated by audio signals inside the target room. Here again, an access to the target space is necessary.

A unique method of modulating light rays (infra-red) with speech is presently under experimentation. This method has a great potential for commercial exploitation since light is almost always available with 'speech' in a room which is being targeted.

Telephone

The best method is to use a wire tape which does not produce any 'clicks' or distortions in speech when the telephone is in use. This is the easiest method as it can be used at any distance between the subscriber and the exchange. The only thing to be kept in mind is that impedance matching is carried out properly.

The most common method is to turn a telephone into a 'bug' even when it is not in use. This technique is called 'compromise' and is the main reason why a telephone is considered a threat to security against bugging. Since this is the most popular method of bugging, it may be discussed in greater detail to make the reader fully conversant with its threat.

All telephone receiving instruments have three devices, all of which are basically transducers, capable of operation in both directions. For example, the receiver (earpiece) of a telephone can also be used as a microphone and vice versa The three transducers in a telephone are: the carbon microphone, the earpiece and the ringer. A number of modifications, which allow the audio to be bypassed while the receiver is on the cradle, can be carried out in this instrument. This does not in any way affect the normal use of the telephone.

The telephone can also be used to hide a number of devices as it has a lot of spare room. And last but not the least, a telephone is an effective and continuous source of power supply for bugs. The device used on telephones is called an 'infinity transmitter' and can be activated by making a psuedo call to make the subscriber lift his telephone and replace it after announcing it a wrong number. The listener can then sit back and record the conversation going on in the targeted area.

Fig. 5: A tunable VHF telephone transmitter. No battery required — uses power from the telephone line. Has a good range and is simple to install.

Assessment of threat

As can be seen, a variety of techniques are possible in bugging. In some cases, two or more techniques may also be used at a time.

The important question is: How does one judge a threat and counter it? This judgement depends much on the information to be protected and the cost effectiveness of its protection methods. A complete analysis of the threat entails consideration of factors such as: Who is interested in the information? What are his financial and technical resources? Are they sufficient to mount a technical attack?

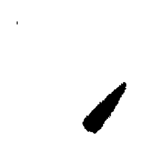

Fig. 6: A combination telephone and room monitoring transmitter Transmits both sides of a conversation and switches automatically to room conversation when telephone is hung up Derives power from the telephone line

In short, the persons in charge of electronic and physical security must first isolate and then nullify the problem areas. One solution is to prevent the attack to be mounted and another is to nullify it when it is mounted. The former is preferable under all circumstances. □

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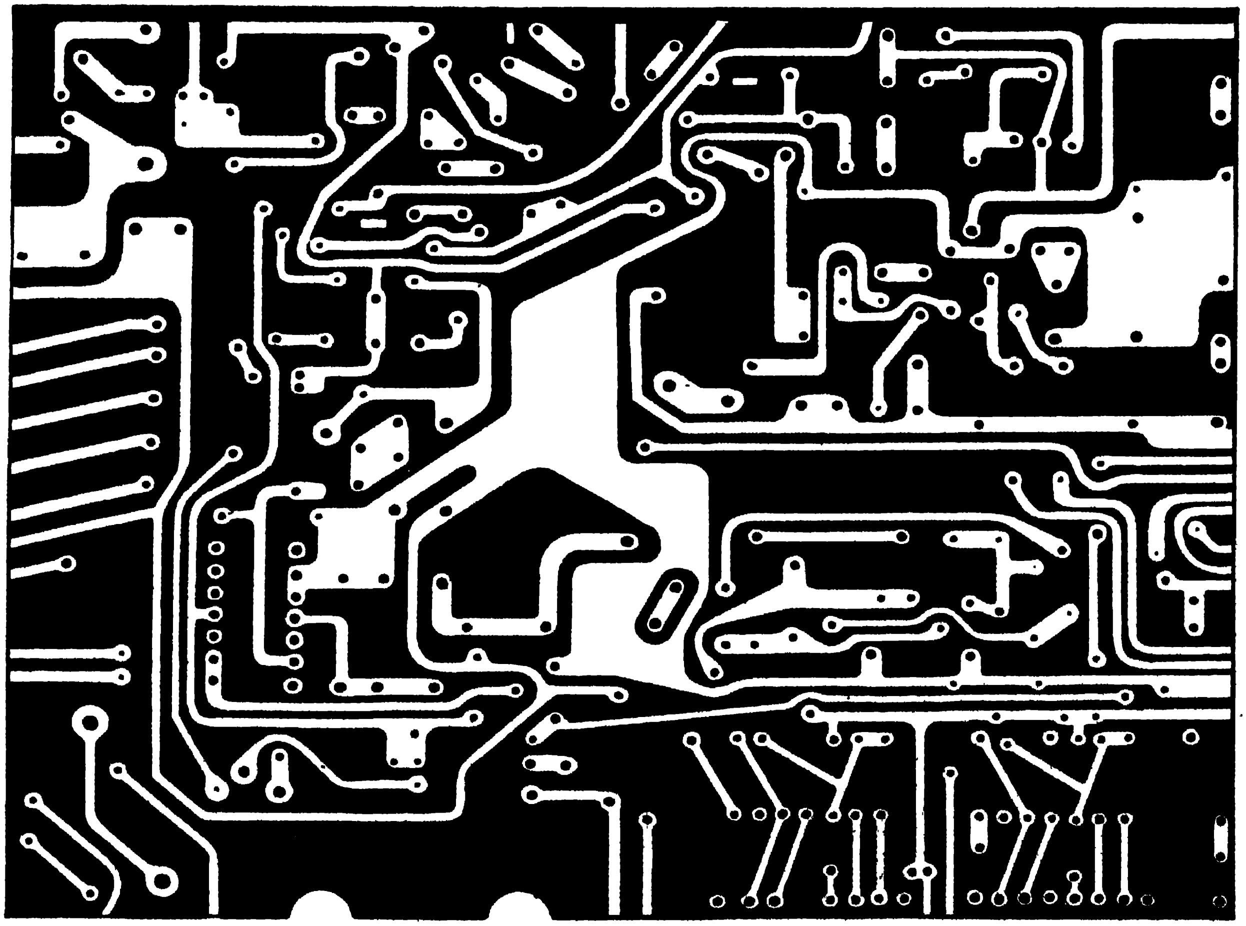

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THE TECHNIQUE OF CIRCUIT PRINTING AND ETCHING

V. K. Haridas

A printed circuit is a pre-determined electronic conductor and/or resistor design reproduced on a base, support, or substrate to which may be attached the required parts making up an electronics assembly. The purpose of the printed circuit is to produce an electrically conducting pattern on an insulating material or base which holds the printed circuit and the miniature components are attached to the base material and connected to the circuit.

This technology is growing fast because it stresses efficiency of design, uniformity and easier maintenance of parts, reduction in cost, and miniaturisation in both circuit and components. Miniaturisation has led to such terms as microcircuits, microelectronics, and integrated circuits, each of which not only expresses smallness but implies better performance, reliability and reduced cost. Miniaturisation produces compactness of parts and saves weight, space, and time.

Printed circuits make changing of circuit design easier than ordinary wiring. Screen printing makes possible the printing of parts close together and allows for variation of design and almost any circuit configuration. However, printed circuits may be designed in almost any size, shape or form. The above advantages and constant acceleration in the growth of circuit printing has resulted in the production of thousands of varied screen printed circuits daily all over the world.

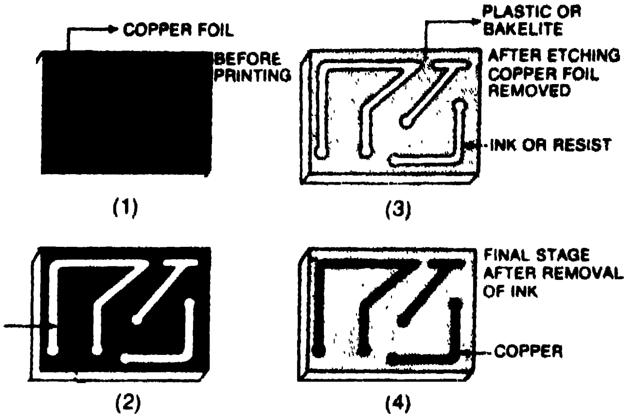
The bases or substrates required for circuit printing are readily available in the market. Most bases used today consist of insulating plastic or bakelite sheets to which is laminated a metal copper foil of the appropriate quality and thickness. The foil is attached either to one or to both sides of the sheet. Generally, the circuit design is screen printed onto the metal foil with a resist ink and the exposed or uncovered metal is etched away. When the resist or ink is removed, the desired circuit is left on the base.

Etching

Etching is a process in which the unwanted portion or layer of material bounded to a base is removed electrochemically. It is often called a subtracting process, since the unwanted areas of a conductor are removed from the surface of the insulator with a chemical solution or etchant.

Before starting to etch circuit boards, a resist coat must be screen printed to the perfectly cleaned and prepared copper foil, leaving uncovered the copper areas which are not to form the circuit. The printed resist must adhere perfectly to the metal foil to prevent undercutting by the etching solution at the printed line edges.

There are a large number of etching solutions available for the removal of copper such as dilute nitric acid, ferric chloride, nitric acid, sodium chloride, ammonium persulfate etc. The etching solution generally used for etching copper is ferric (iron) chloride.



In choosing the etching solution, the processor must consider speed and quality of etching as well as cost and safety factors. The processor must realise that the actual etching depends on the type of solution, temperature, thickness of metal or amount of metal to be removed, the strength of the solution, and the continuous application of solution to copper.

After the boards are etched, they are rinsed in water, air dried in appropriate racks, and screen printed resist removed from them with a solvent or a commercial solution recommended by the manufacturer of the resist. The etched circuit must be cleaned off perfectly in order to avoid contamination of the insulating material. A good design of the etching bath, careful renewing of the etchant, as well as proper rinsing of boards after etching, are all helpful in preventing contamination.

Generally, etching demands knowledge of the product to be produced, knowledge of etching processes as they relate to other processing, control of etching conditions and a safe method of disposal of etching solutions. The processor who does a lot of etching should first make trial etchings when using new materials, solutions or processes. The necessary techniques can only be acquired by practice.

Today a wide variety of screen printing techniques are in use. Although the screen process, the skill, and the varied equipment in the different phases of screen process printing are common, the electronic circuit screen printer is developing materials, skills, and equipment peculiar to his or her type of reproduction. As a result, screen printing is having an impact not only on its own industry but also on others; its flexibility in the varied graphic communications is creating industrial changes and new developments in other industries as well. ☐

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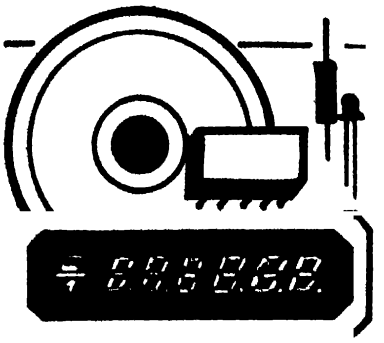

Electronics Components Industry in India

Any building is as strong as its foundation. The strength of the electronics industry depends upon the quality of the components used. The analogy between the two is so close that it hardly needs any elucidation.

That the electronics industry in this country is not able to procure all the components that it needs, and of high quality, is a well-known fact. This fact has been highlighted in every convention and seminar held anywhere in this country during the past few years.

However, the electronics components industry in our country has taken rapid strides during the past decade in so far as the value of production is concerned. In 1965-66, the value of electronic components produced was no more than Rs 65 million. By 1975 (January to December) it had multiplied more than 10 times to reach the level of Rs 750 million. In 1977, it had risen further to Rs 905 million. Even though the data for 1978 is not available at the time of writing, there is no doubt that their output has crossed the Rs 1,000 million mark.

In order to measure the real growth of the electronics components industry, it will be necessary to deflate these figures with a suitable price index. Prices, in general, have been moving up during the past dozen years, though the prices of certain components have fallen with increased demand and consequent production.

But even this fast rate of growth in the manufacture of electronics components has not been quick enough to catch up with the rising demand of many of the components. Our country is currently experiencing shortage of certain components such as receiving valves, carbon film resistors, electrolytic capacitors, ceramic capacitors, plastic film capacitors — all of which are needed by the consumer electronics industry. Consequently, the government has allowed from time to time the import of components to actual users.

According to an analysis made by the Department of Electronics, equipment production increased by 80 per cent from 1974 to 1977 while the output of components rose by 26 per cent only. Understandably, the present imbalance in the production of components and equipment is the direct result of the varying rates of growth of these two major sectors of the industry.

Research and development (R&D) in the electronics industry abroad has made very fast progress during the past decade with the result that new types of components are being increasingly used. Their chief merit lies in their being more efficient and less costly in the long run. That is why the rate of obsolescence is the highest in this country.

An industry which is dogged by a fast rate of obsolescence needs some incentives to survive. The electronics components industry has repeatedly represented to the government for fiscal incentives such as increased depreciation allowance, provision for investment allowance out of pre-tax profits, application of appropriate debt-equity ratio and reduction in import duties on raw materials needed by the industry. The Department of Electronics has endorsed the viewpoint of the manufacturers of electronic components.

A recent analysis made by the Components and Materials Division of IPAG clearly pointed out the need for providing higher rates of depreciation allowance in this industry to encourage fresh investment. It is the view of the Department of Electronics that such a step would "have a positive impact on the capacity utilisation and modernisation of the electronics components industry." However, the central ministry of Finance refuses to entertain the plea of the electronicsmen. It is the task of Dr B. Nag and his men to bring round the ministry of Finance which even today treats the electronics industry as a luxury industry.

The annual report of the Department of Electronics for 1977-78 had pleaded for a reduction in import duties on raw materials. Said the report: "Another aspect which needs urgent attention is the high incidence of import duty on raw materials which is about 50 per cent of the total raw material cost." The Department of Electronics had identified the products whose prices get inflated due to the high incidence of import duty. It is for the ministries concerned to come to the succour of units manufacturing these products.

Last year, the government had reduced import duties on 30 raw materials and piece parts required for the manufacture of electronic products, but even after reduction the rates applicable ranged between 45 and 75 per cent (see Table I). There is room for further concessions in this regard if the government is keen to increase the production of electronic components.

So far, the protestations of the Department of Electronics and that of ELCINA have not brought forth the

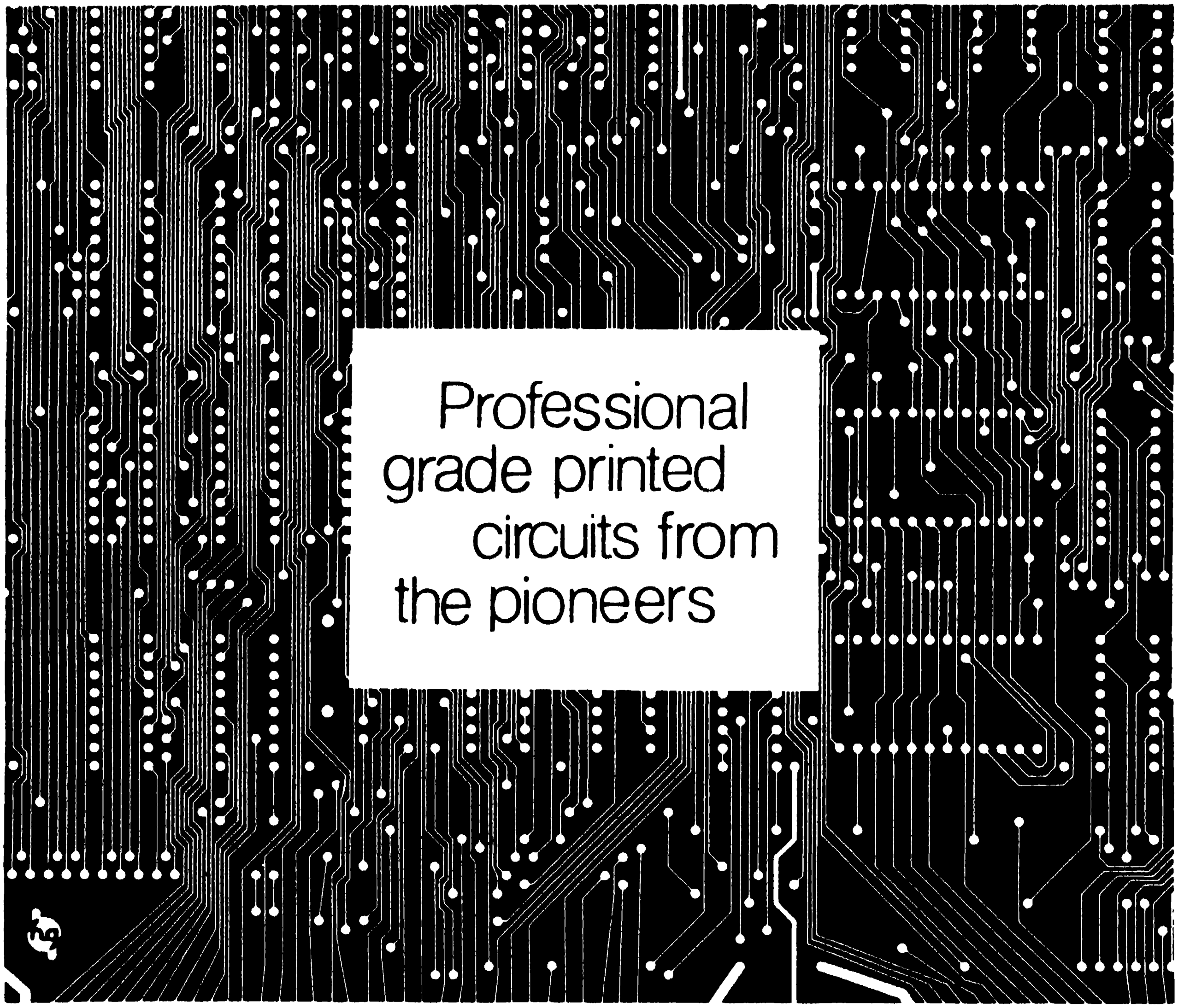
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Table I: List of the Raw Materials and Piece Parts required for the manufacture of Electronic Components for which the duty reduction has been considered by the government and notifications issued to that effect—Position as on November 30, 1978.

S. No. *(1)*	*Electronic component in which items listed in next col. are used* *(2)*	*Name of the raw material/ piece parts* *(3)*	*Original duty* *(4)*	*Redu-ced duty* *(5)*
	Reed relays	Infra-red absorbing glass tubes	208%	45%
		Rhodium electroplating salts	120%	45%
		Rhodium electroplating replenisher salts	120%	45%
2.	Carbon film resistors of power rating up to 20 watt	Ceramic rods	75-208%	45%
		Ceramic tubes	75-208%	45%
3.	Metal film resistors of power rating up to 20 watt	Epoxide resins	208%	45%
4.	Metal oxide film resistors of power rating up to 20 watt			
5.	TV deflection components	Self-bonding insulated copper winding wire	75%	45%
6.	Transistor headers	Glass powder	120%	45%
		Glass pallets	120-208%	45%
		Metal eyelets	75%	45%
7.	TV picture tubes	TV glass shell	186%	75%
8.	Metallised plastic film for capacitors	Plastic film	208%	75%
9.	Plastic film capacitors	Plastic film	208%	75%
10.	Mica capacitors	Silver powder suspension	120%	45%
11.	Mica capacitor plates	Silver powder suspension	120%	45%
12.	Printed circuit boards	Photoresist, Photopolymer films	120%	45%
13.	Diodes, Transistors and similar semiconductor devices	Silicon wafers	75%	45%
14.	Monolithic and hybrid integrated circuits.	Epoxy resins and silicon resins	208%	45%
		Photoresist	120%	45%
		Oxygen free, high conductivity wire, sheets, rods or tubes	75%	45%
15.	Solid tantalum capacitors	Silicone elastomer	120%	45%
		Silicone rubber tube	120%	45%
		Epoxide resins	208%	45%
		Nickel wire	75%	45%
		Silver powder suspension	120%	45%
		Tantalum wire	75%	45%
16.	Connectors	Di-Allyal Phthalate	208%	45%

(1)	(2)	(3)	(4)	(5)
17.	Switches	Moulding powder		
18.	X-ray tubes	Glass bulbs or glass envelopes	120%	45%
		Glass rods	120%	45%
		Glass tubes	120%	45%
		Insulated high tension X-ray cable	120%	45%
		Molybdenum wrought in all forms	75%	45%
19.	Transmitting tubes	Glass bulbs or glass envelopes	120%	45%
		Glass rods	120%	45%
		Glass tubes	120%	45%
		Glass rings	120%	45%
		Glass powder	120%	45%
		Molybdenum wrought in all forms	75%	45%
		Molybdenum alloys wrought in all forms	75%	45%
		Tungsten wrought in all forms	75%	45%
		Tungsten alloys wrought in all forms	75%	45%
		Parts of transmitting tubes	120%	45%
20.	Electronic valves	Oxygen-free high conductivity copper wire, sheet, rod or tubes	75%	45%
21.	Phenolic or glass epoxy copper clad laminates	Copper foil	75%	45%
	Capacitors	Unalloyed aluminium foil other than etched or formed aluminium foil	75%	45%
23.	Etched aluminium foil			
24.	Magnetic tapes	Gamma ferrix oxide	120%	45%
		Polyester film	208%	45%
25.	Ceramic capacitors	Silver powder suspension	120%	45%
26.	Potentiometers			
27.	Mini motors 4.5 to 7.5 volt and current rating up to 200 milliamperes	Parts of commutator assembly	75%	45%
		Rotor spindle	75%	45%
		Ferrite permanent magnets	120%	45%
28.	Cathode ray tubes	Glass bulbs or glass envelopes	120%	45%
		Glass rods and glass tubes	120%	45%
		Parts of cathode ray tubes	120%	45%
29.	Indium, electronic grade	Indium	45%	Nil
30.	For all uses such as in coils, transformers	Insulated copper wire thinner than 44 SWG	75%	45%

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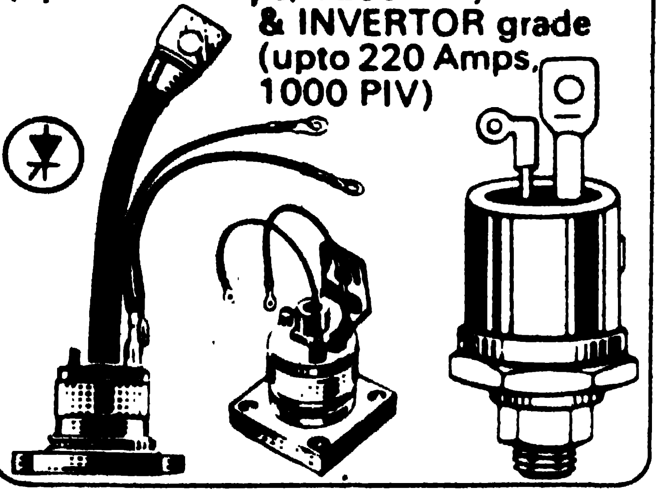

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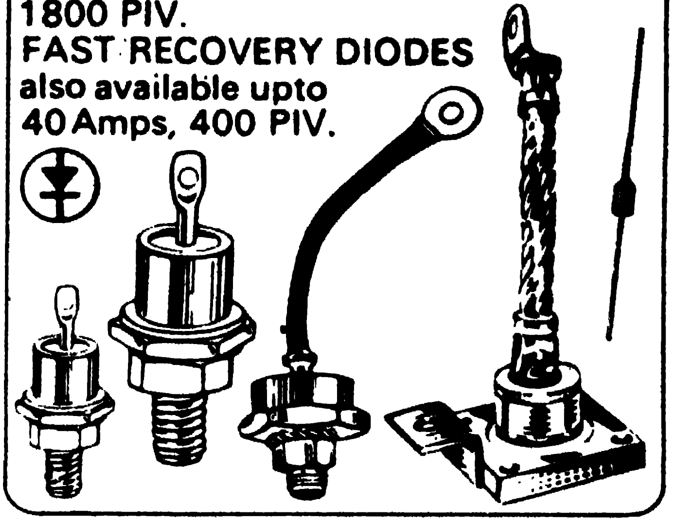

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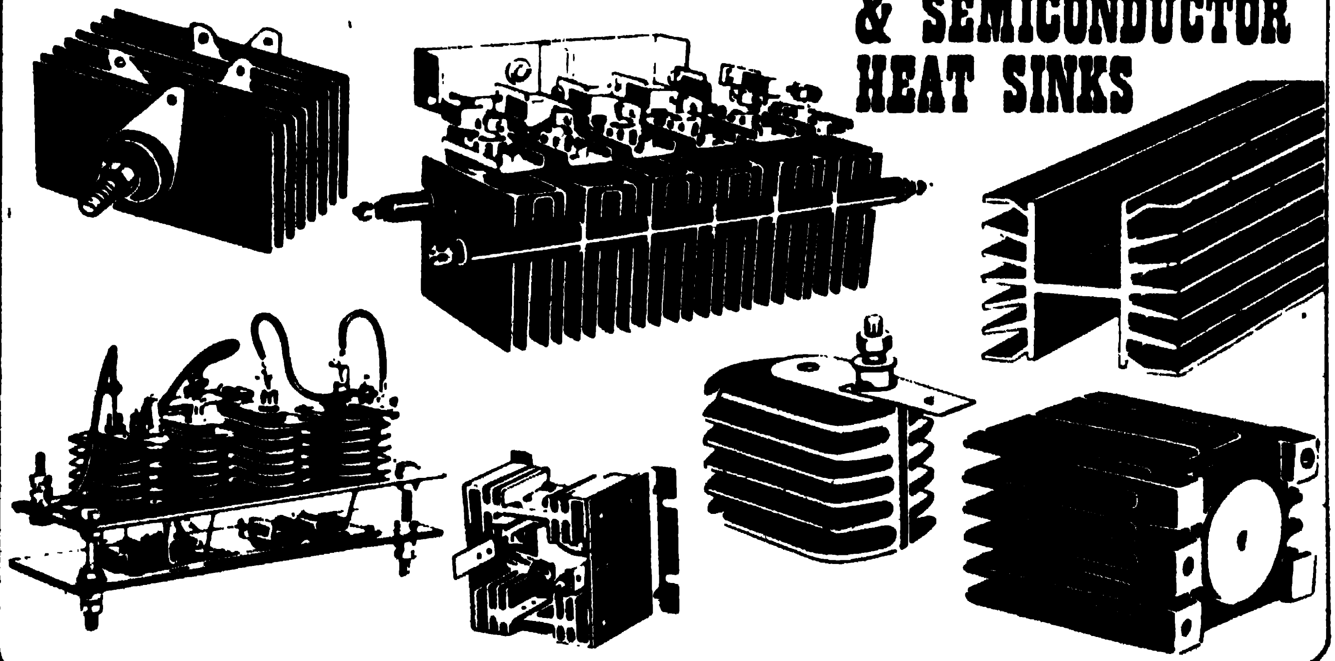

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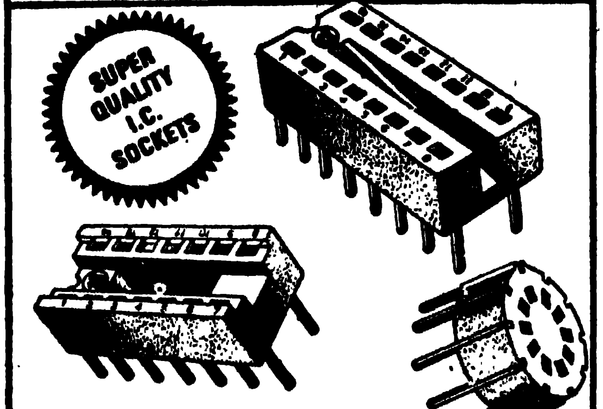

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requisite response from the government. The press has lent all support in this regard. Unfortunately, the Prime Minister has hardly any time to look into the affairs of the Department of Electronics and the Parliament does not have an energetic band of members who may be actively interested in the interests of this industry. So, even the vital needs of the components industry stand neglected.

The USA is in the lead in the research and development of the electronics industry. Its supremacy is unrivalled. However, every other developed country has recognised the importance of R&D in this industry. Britain, in particular, has realised the importance that needs to be given to microelectronics which is based on a new concept, and which not only depends upon a new series of components but also has wide-ranging social and employment implications.

Before going any further, it is necessary to define 'microelectronics' which stands for electronics components or circuits of very small dimensions. There are a number of microelectronic devices but the best known today is the silicon integrated circuit (IC). An IC is produced by creating a succession of very thin layers of metal and component material on a silicon wafer, using a series of photographic masks to achieve the desired pattern of electronics components and interconnections in the micro-circuit. The technique has been perfected to a point where thousands of individual circuit components can be formed into a single microcircuit 'chip' measuring about 6 mm square. This chip is the heart of microelectronics and enables the production of cheap, reliable and compact electronic devices with a performance which has hitherto been available only from bulky and expensive mainframe computers.

In Britain, the advent of microelectronics is being looked upon with a mixture of hope and fear. The hopes focus on the possibilities which will be opened up for new and improved production methods and hence better working conditions, widespread use of advanced forms of telecommunication, improved public services, especially in such

Table II: Production data of Electronic Components

S. No.	*Components*	*Licensed capacity/ installed capacity**	*Letters of intent capacity**	*SSI approved capacity*	*Production in organised sector*	
					1976	*1977*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
I.	**Electron tubes**					
	1. Receiving tubes	10.00/10.00			3.628	3.829
	2. Transmitting tubes	36,000/18,000	10,600		9,400	10,407
	3. Microwave tubes (Nos.)	300/200	50		260	190
	4. TV picture tubes	0.420/0.136	0.04		0.055	0.091
	5. CR tubes (Nos.)	10,500/2,500	4,500	2,000	700	1,162
	6. Photo and image intensifiers tubes (Nos.)	—	1,500		100	100
	7. X-ray tubes (Nos.)	3,600/1,800			1,321	1,400
II.	**Semiconductor devices**					
	1 Transistors and diodes	241.3/87.4	137		52.914	65.00
		(111.40)	(100.75)			
	2. Integrated circuits	4.4/0.50	2.31		0.272	0.41
	3. Power diodes (< 30A)	3.54/1.41	8.3		0.884	0.875
	(> 30A)	0.228/0.115				
	4. SCRs (< 30A)	1.15/0.34	1.25	18.5	0.016	0.028
	(> 30A)	0.16/0.05	0.10			
III.	**(A) Resistors (fixed)**					
	1. Carbon film resistors	233.5/184.0	189.0	76.7	128.312	169.12
		(16.25)	(126.25)			
	2. Metal film/metal oxide film	12.00/6.00	50.000	37.5	1.149	1.013
	3. Wirewound	2.3/2.2	3	7.5	0.798	0.978
			(1.5)			

(1)	*(2)*	*(3)*	*(4)*	*(5)*		
	4. Thermistors/varistors	5.0/4.0		4.1	0.505	0.831
(B)	**Resistors (variable)**					
	1. Carbon track potentiometers	8.24/4.19	4.0	14.2 (3.0)	4.579	5.408
	2. Wirewound potentiometers	0.89/0.24 (0.1)	0.5	2.35	0.15	0.127
(C)	**Capacitors (fixed)**					
	1. Paper	12.7/12.1	0.6	—	1.771	1.42
	2. Plastic film capacitors	122.75/94.75 (15.7)	105.0 (17.2)	43.83 (0.6)	35.735	46.03
	3. Electrolytic capacitors	63.7/40.2 (20.5)	65.0	41.84 (3.5)	15.104	17.448
	4. Tantalum capacitors	12.75/0.40 (10.40)	—	—	0.410	0.493
	5. Ceramic capacitors	240.00/68.00 (74.25)	125.0 (56.25)	32.6 (8.0)	47.596	64.24
	6. Mica capacitors, mica	17.40/7.00	—	93.00	2.262	1.795
	plate parts	232.0(200.00)	—	(70.00)	145.666	185.12
(D)	**Capacitors (variable)**					
	1. Gang condensors	8.09/6.64 (2.25)	1.2	3.2 (1.5)	2.866	3.125
	2. Trimmers	30.24/10.24	6.0	1.2	2.733	2.833
IV.	**Other passive components**					
	1. TV deflection component	0.03/0.03	—	0.58	1.680 Rs million	—
	2. Loudspeakers	4.29/3.033	(2.0)	3.7	2.737	3.017
	3. Microphones	0.11/0.01	0.056	1.25	0.0025	0.0026
	4. Crystals	0.12/0.36	3.12	—	0.179	0.193
	5. Magnetic heads	0.55/(0.375)	(0.6)	0.9	—	—
	6. Cartridges	0.35/0.35 (0.12)	—	0.74	0.075	0.062
	7. Stylus	0.30/0.30 (0.12)	—	0.24	0.039	0.038
	8. Magnetic tapes (MRM)	184/80.00	410	174	56.00	41.04
	9. Ferrites Soft (tons)	392/280	40	101.5 (18)	150.18	192.56
	Hard (tons)	800/460	300	211.5 (135)	257.913	404.09
	10. Permanent magnets (tons)	741.6/741.6	23.4	—	224.542	255.00
V.	**Ele nical components**					
	1. Connectors	5.313/1.21 (0.70)	2.50	2.2 (0.1)	0.314	0.345
	2. Relays (electromagnetic)	0.57/0.225	1.03	1.07	0.192	0.240
	3. Reed relays & reed switches	9.10/2.76 (1.80)	—	2.25 (1.32)	0.325	0.695
	4. Switches	6.20/3.42	1.96	0.07	0.957	1.111
	5. Printed circuit boards (million sq. mtrs)	0.01 (0.005)	0.015 (0.0003)	0.09	(1.723) Rs million	(1.927)
	6. Tape decks	0.12	—	0.25	—	—
	7. DC micromotors	0.05	0.01	0.34 (0.03)	—	—

Note: (1) *Export figures are in brackets.
(2) The quantities are in million numbers, except when otherwise specified.

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Table: III. Demand projections of Components for 1983-84

S. No.	*Components*	*Demand 1983-84*	
		Numbers (million)	*Value (in Rs million at 1977-78 prices)*
(1)	*(2)*	*(3)*	*(4)*
I.	**Electron tubes**		
1.	Receiving valves	6.000	50.0
2.	Transmitting tubes	0.025	40.0
3.	TV picture tubes	0.800	280.0
4.	Special tubes		110.0
5.	Others		40.0
	Electron tubes total		520.0
II.	**Semiconductor devices**		
(A)	**Small signal devices**		
1.	Signal diodes	20	25.0
2.	Rectifying diodes up to 1A	30	30.0
3.	Zener diodes	6	12.5
4.	Transistors	150	150.0
5.	Discrete, special		
(i)	Microwave diodes	0.1	10.0
(ii)	Microwave transistors	0.05	5.0
(iii)	Others	—	5.0
6.	Opto-electronic devices		
(i)	LED digits	1.5	7.5
(ii)	LED lamps	3.0	5.0
(iii)	LCD displays	2.5	40.0
			290.0
(B)	**Power devices**		
1.	Rectifiers lower power (< 30A)	4.0	15.0
2.	Rectifiers high power (> 30A)	0.2	50.0
3.	SCRs/triacs/diacs	5.0	40.0
4.	Thyristers	2.0	75.0
5.	Power transistors	3.0	30.0
			210.0
(C)	**Integrated circuits**		
1.	Linear	3.0	60.0
2.	Digital-SSI/MSI	3.0	30.0
3.	LSI		
(i)	Calculators	1.0	25.0
(ii)	Watches	1.5	45.0
(iii)	Computers	—	60.0
(iv)	Microprocessors	—	20.0
(v)	Others	—	20.0
4.	Hybrid	—	50.0
			300.0
	Semiconductor devices total		800.0
III.	**Resistors**		
(A)	**Fixed**		
1.	Carbon film	700.0	40.0
2.	Metal film	25.0	25.0
3.	Wirewound	15.0	15.0
4.	Thermisters/varisters	25.0	5.0
(B)	**Variable**		
1.	Carbon track	30.0	50.0
2.	Wirewound	5.0	25.0
	Resistors total		160.0
IV.	**Capacitors**		
(A)	**Fixed**		
1.	Paper	2.5	5.0
2.	Plastic film	250.0	100.0
3.	Electrolytic, Aluminium	90.0	90.0
4.	Electrolytic, Tantalum	4.0	40.0
5.	Ceramic	250.0	50.0
6.	Mica	20.0	20.0
7.	Mica plate parts		20.0
(B)	**Variable**		
1.	Gang	10.0	50.0
2.	Trimmer		
(i)	Consumer	30.0	25.0
(ii)	Professional	5.0	
	Capacitors total		400.0
V.	**Connectors**		
1.	Coaxial	2.5	35.0
2.	Cylindrical	1.2	35.0
3.	Rack and panel	1.5	45.0
4.	Printed circuit	5.0	75.0
5.	Miscellaneous	2.0	10.0
	Connectors total		200.0
VI.	**Relay**		
1.	Hermetically sealed	0.2	40.0
2.	Unsealed type	0.5	20.0
3.	Reed	1.5	30.0
4.	Telephone type	0.4	10.0*
5.	Miscellaneous	0.2	20.0
	Relays total*		120.0
VII.	**Switches**		
1.	Rotary	1.5	30.0
2.	Push button	2.5	20.0
3.	Toggle	2.5	25.0
4.	Sensitive	0.5	2.5
5.	Reed	3.0	15.0
6.	Slide	5.0	12.5
7.	Miscellaneous	2.5	25.0
	Switches total		130.0

')	(2)	(3)	(4)
III	**Other components**		
1.	Loudspeakers	12.5	100.0
2.	Ferrites		
	(i) Soft	600 M. ton	20.0
	(ii) Hard	1,000 M. ton	25.0
3.	Permanent magnets	400 M. ton	40.0
4	Magnetic tape		
	(i) Consumer (1.25 cm width)	500 MRM	40.0
	(ii) Professional (1.25 cm width)	120 MRM	50.0
5.	Crystals		
	(i) For watches	1.5	25.0
	(ii) For other	0.5	25.0
6.	Deflection components	0.8	70.0
7.	Microphones	1.2	35.0
8.	Magnetic heads	0.7	10.0
9.	Cartridges	0.3	3.0
10.	Stylii	0.4	2.0
11.	TV tuners (multichannel)	0.8	100.0
12.	Micromotors	0.9	25.0
13.	Printed circuit boards (2.5% of equipment cost)		
	(i) Consumer	0.25 million sq. metre	275 0
	(ii) Professional	0.085 million sq. metre	—
14.	Microwave passive components (excluding system-oriented components)	—	50.0
15.	Control components including transducers	—	65.0
16.	Transformers, chokes & coils (4% of equipment cost)	—	440.0
17.	Batteries		
	(i) For electronic watches	15 new watches, 20 replacement	50.0
	(ii) Ni-Cd batteries	1.0	20.0
	Others total		1,470.0
	Components total		3,800.0

Total does not include telephone type relays (BPO 3000 and 600 type and pentaconta type) as they are being produced for captive consumption by ITI, Bangalore.

fields as medical diagnosis and treatment, and education.

The fears centre mainly on the impact on employment. The industrial circles predict increased unemployment as a result of the introduction of microelectronics. The Central Policy Review Staff in the British Cabinet Office has produced a report in this regard which is entitled as 'Social and Employment Implication of Microelectronics.' It has arrived at the conclusion that in the ensuing worldwide competition, Britain will lag behind if it did not push ahead in this field. The government in Britain has planned to support the development of capability in the design and manufacture of the new devices. The £70-million Microelectronics Industry Support Programme announced last year is expected to generate £200 million of investment in both standard and special microelectronics.

In our country, the paucity of resources is responsible for a major thrust in this direction. Even though electronics is known to be a priority industry, it is not included in the ninth schedule to the Income-tax Act. Hence, it does not enjoy some of the concessions which priority industries enjoy in this country. All pleas by the indigenous industry have fallen on deaf ears.

In the corridors of the central secretariat, electronics means consumer electronics only. This comes under luxury and hence is punished heavily by way of taxes. What is needed is a refresher course for the officials of the Ministry of Finance in the central secretariat so that they may realise that electronics has bounced beyond the bounds of consumer electronics and has in fact added efficiency to each and every industry. Retarding influences in the case of the electronics industry can be detrimental for the long-term growth of the industrial sector in our economy.

The present status of the electronics components industry in this country is set out in Table II. The available information is given under five broad heads such as electron tubes, semiconductor devices, resistors, other passive components and electromechanical components. Besides the production data for the years 1974 to 1977, the table provides information regarding licensed or installed capacity, the letters of intent capacity and capacity approved for the small-scale industrial units.

The subgroup on Components and Materials which was a part of the Planning Commission Working Group on the electronics industry has forecast the demand for electronic components in 1983-84 in this country. Its findings are summarised in Table III. It will be seen that the total value of components demand is expected to rise to Rs 3800 million in 1983-84. The demand for semiconductor devices is anticipated to increase to Rs 800 million followed by electron tubes at Rs 520 million, capacitors at Rs 400 million, connectors at Rs 200 million, resistors at Rs 160 million, relays at Rs 120 million, switches at Rs 130 million and other components at Rs 3800 million. ☐

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STRATEGY FOR THE SCIENTIFIC DEVELOPMENT OF THE COMPONENTS INDUSTRY IN THE NEXT DECADE

R. Venkatraman

The electronics industry — and within it the components industry in particular — has come a long way in the last 20 years. Today almost every electronic component is available in the country and some components and equipments are also being exported to various parts of the world.

It is therefore time to think of the next phase in the evolution of the components industry and to concentrate on the areas identified as a bottleneck to growth. Undoubtedly, a planned programme is needed to achieve faster growth in selected fields, in order to catch up with international developments.

Achievements

The production of components has increased from a mere 5 million rupees in 1960-61 to Rs 920 million in 1977-78. Moreover, 60 per cent of the components industry's requirements are today met indigenously as against 10 percent in 1960. This is no mean achievement, considering the growth in technology itself in the last 20 years.

Constraints

A whole range of new semiconductor devices and attendant components, introduced in the market recently, have revolutionised the equipment industry. Costs of production of these devices have been falling drastically. This has resulted in a tough competition. Moreover, these devices suffer from extremely high obsolescence rates. Investors are therefore hesitant to deploy their funds in this direction.

With such drastic changes in availability, and functional improvements in active devices, new standards of size, performance and costs have come up in the fields of passive electro-mechanical and electro-magnetic components.

In addition, complexities in system engineering and performance requirements in the aerospace, defence and nuclear fields calls for higher standards of reliability for an effective functioning of systems. Under these circumstances, the growth of the industry becomes difficult.

These constraints can be mitigated by careful planning. But, with the inefficiency inherent in the Indian bureaucratic system and the long delays involved in getting even the smallest departure from the existing technology approved by powers-that-be, growth can become rather painful.

Need for a strong R&D base

No foundation for growth will be strong without a good in house R&D programme, irrespective of whether the technology is imported or developed indigenously. The R&D programmes currently visualised emphasize growth in specific sectors identified as important. This approach should change and emphasis should be laid on all-round development.

To be more specific, R&D should encompass continuous testing of end products, monitoring of production lines and raw material evaluation in the existing products as a prelude to better understanding of the existing quality levels. R&D policies should become more liberal and encourage in-house testing facilities in addition to the state and national level facilities available today.

In this context, the importance of production engineering and the development of production machinery should not be forgotten. An end product, acceptable to the user, is developed by using the right mixture of R&D, engineering, equipment, retraining and quality control. Such cohesive efforts are sadly absent in the Indian electronics industry today.

Today manufacturers should lay more emphasis on investing a certain percentage of their total turnover on R&D. The present method of R&D approvals being granted by the Ministry of Science & Technology based on approved projects should be dispensed with as growth requirements are not isolated in particular projects alone. Similarly, the existing facilities of importing samples, equipment etc. up to Rs 500,000 to the approved R&D houses should be extended to all manufacturing units in proportion to either their turnover or their specific requirements.

As a matter of fact, the present method handicaps smaller units developing and productionising their own equipment and components since they are not able to allocate specific staff and facilities for the purpose. Nor do these units require the Rs 500,000 per annum facility for importing capital goods and material for development. What they need and visualise as R&D are those small changes in

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materials, components and cost which improve the marketability and reliability of their products.

Therefore, while providing R&D facilities, it should be kept in mind that (i) all R&D need not be costly and be done on a large scale to produce the desired results, and (ii) that endless difficulties are faced by small-scale manufacturers when they want to import material or machinery to try out a small idea.

Need for a strong infrastructure in the other industries

As electronics is so much a part of other industries, developments in other industries too affect the growth of electronics. Typically, the capabilities of the chemical industry limits the growth of high-purity semiconductors so much needed in electronics. Similarly, the mask-making capabilities determine the level of efforts in IC manufacture. Metals, insulators, gases are all required to specifications which are beyond the ability of Indian industries. Likewise dies, tools and machinery required for production are sometimes so difficult to get that many a production venture has to be shelved. In a number of cases while the technology has been developed, the machinery is not available on free sale and ultimately royalty and knowhow fees have to be paid to purchase the machinery.

It is not possible for the electronics industry to dictate the growth of other industries. Hence a certain amount of inbuilt imbalance is bound to be present at any particular stage of the industry's growth, and these dynamic imbalances are vital to growth.

However, it is possible to somewhat reduce the imbalances by promoting interests in allied fields. For example, a National Institute of Special Materials or even an Institute of Material Sciences will go a long way in improving product standards. Similarly, an institute for special-purpose machines could be the answer in taking up production machineries. Though some efforts have sporadically been made in this direction, the indifferent attitude toward these vital problems has resulted in nothing concrete ever being done.

Admittedly, it is not possible to visualise development of every material needed for the electronics industry and neither is this essential. There are cases where a small quantity of a material is needed and there are a number of sources from where it can be bought. There are also cases where the supply of a small value and quantity material is the monopoly of some country or company likely to be closed down in an emergency. These are matters of detail best left to the experts in the line. What is essential is that a certain base must be present, so that any material required can be delivered immediately.

Self-reliance vs collaborations

It is necessary to be self-reliant. But there are occasions where time is a factor, i.e. a project has to be completed within a certain time frame but estimates indicate a longer period of gestation if only indigenous technology is used. In such an event the issue can be considered strictly on merit.

What offends the 'self-reliance' school of thought is the abject poverty of self-confidence with which people decide on collaborations. If someone trys to buy steel with the least knowledge of the varying prices and qualities of this material, he will definitely end up paying a high price and getting a material of inferior quality.

This is what is happening in most of our collaborations. In the international market everything is bargainable, even freight rates. But then bargains can be made only from a position of strength. Thus, even to buy a collaboration, one needs considerable knowledge of the subject, and that is what self-reliance is all about.

Indians tend to approach the problem emotionally. There have been letters from Indian manufacturers to their foreign counterparts to supply so-and-so plant *similar* to the one supplied to so-and-so, without even knowing what the end product is. There are cases where collaborations have been promoted (especially in the public sector) because of the temptation of the foreign trip. There are also cases where they are promoted simply because it is 'foreign.'

As the Indian electronics components industry needs a very strong R&D base, collaborations should be treated as a simple matter of buying time(other peoples' time spent on innovating and perfecting), if it suits our requirements and purse.

Public sector vs private sector

There is nothing inherently bad in the public sector and good in the private sector. The public sector suffers from a confusion of objectives, i.e. it is unable to decide whether its main objective is to be a model employer, a pioneer or something else. In any case, efficiency seems to be the last thing in the minds of those who run the public sector, as there is an absolute lack of work norms, accountability and industrial culture in this sector.

The public sector gives greater priority to welfare objectives than to efficiency. But the salary paid or payable is irrelevant if employees remain idle and are not used properly to carry out the main function of the enterprise, i.e. to produce. Bringing in the welfare concept before inculcating industrial culture is suicidal.

The private sector has its own weaknesses. In fact, the larger private sector undertakings are only a little better than the public sector units. But the public sector units have generally fared better in so far as they have recognised the need for an R&D base, and have not hesitated to enter capital-scarce fields.

Economic constraints to growth

The high rate of obsolescence in the components industry has scared the investors. On top of this, due to archaic depreciation laws (the value of an equipment used in two shifts is 25 per cent after 10 years) records of machinery and instruments are kept in account books long after their life is over. Where new investments and technologies are needed it is necessary to achieve faster write offs. Typically, capital equipment should be written off within three to five years to enable the manufacturers to update their processes.

There is also the anachronism of high custom duties. Most materials imported for the electronics industry attract 120 per cent duty. Components attract 75 per cent duty and 40 per cent duty is levied on complete equipment. This makes it easier to import full equipment than to import parts and assemblies.

Conclusion

A detailed consideration of the constraints to growth has brought a number of points to light which can be summarised as follows:

1. A fast changing industry needs a fast response. Our regulatory and promotional organisations must, therefore, be tuned to a fast response.

2. R&D facilities should be encouraged across the board in the components industry. Facilities should be available to buy or import much more easily for the small-scale firm. Import policies should be framed accordingly.

3. Material sciences must be promoted vigorously. An institute to plan and coordinate research in various fields would be in order.

4. Machine building facilities must be promoted on a

7. Fiscal policies should be oriented to recognise the changes in the modern industrial field.

8. Lastly, greater efforts should be made to make common standards for the industry.

planned basis to engineer products developed in various fields. Here again, an organisation at the level of an all-India institute is needed.

5. The basic approach to collaboration should be to strengthen our own technology. To promote this, collaborations should be encouraged in the existing successful units where a certain standard of quality has already been built-up and where higher technology can be easily absorbed. Buying technology like vegetables should be avoided.

6. The constant wavering of priorities between the public and private sector should be eliminated. Every project should be analysed on its merit

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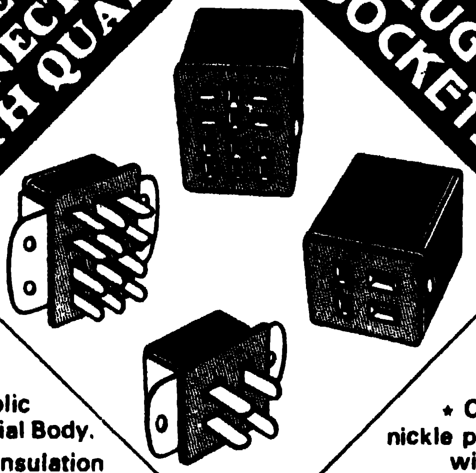

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Sudhakar N. Joshi

The silicon controlled rectifier (SCR) is a three-terminal pnpn semiconductor device with characteristics similar to those of a thyratron. The application of SCRs in industrial and commercial power control systems has grown considerably in India in the last few years. High-voltage high-power controlled rectifiers have created a new concept of solidstate power control systems. Conventional AC/DC general-purpose capacitors are unsuitable for these applications. Capacitors for these applications require high peak and RMS current ratings, high insulation resistance, low power factor and low inductance.

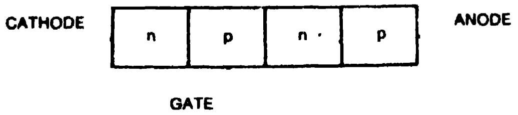

Fig. 1: PNPN SCR structure

SCR operation

The function of the pnpn structure (Fig. 1) is that of controlling power by serving as a switch. The SCR acts like a diode (Fig. 2) in the reverse direction, blocking current from cathode to anode. In the forward direction, the current is blocked until it is turned on by a pulse between the gate and the cathode. The 'on' state is characterised by an extremely low forward impedance and the current flow is limited only by the external circuit.

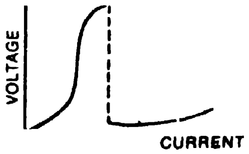

Fig. 2: SCR V/I characteristics

Capacitor switching

The SCRs can trigger on large currents with very small gate current levels. However, the controlled rectifier loses the gate control of the anode current after the conduction begins. The SCR must be turned off by reducing the anode current flow below the device holding current. For AC applications this problem does not exist because the device turns off at the end of the conduction half-cycle when the anode voltage becomes zero.

A fast turnoff is normally desired in high frequency operations. This is achieved by the use of a charged capacitor delivering energy into the SCR when allowed to reverse bias SCR in the conducting state. The device will conduct a high reverse current, discharging the capacitor. Fig. 3 shows a typical capacitor switching the SCR circuit.

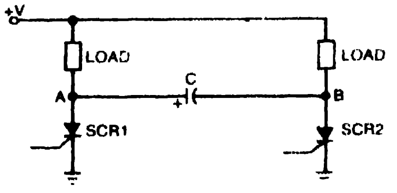

Fig 3: Capacitor Switching

SCR1 is assumed to be 'on' and SCR2 is assumed to be 'off' with on gating signals applied. Because SCR1 is conducting, the voltage level at point A is nearly zero and with SCR2 'off' the voltage at point B will be very close to +V. The capacitor C is charged to +V. If a gating signal is applied to SCR2, it will turn on virtually instantaneously. The voltage at point B will drop to zero and a negative voltage pulse is seen at A, putting a reverse voltage across SCR1. This discharges the capacitor through the SCR, resulting in SCR1 being turned off.

High power SCR applications

Industrial uses of high power SCRs include power conversion, frequency conversion, power and process control functions in chemical, steel and petroleum industries. Fig. 4 shows a typical chopper circuit for DC motor speed control. The effect of the chopper is to release power in short bursts, the duration of each burst controlling the speed of the motor.

The solidstate motor controls are a big improvement over auto transformers, potentiometers or variable gear trains because of their better torque characteristics. The chopper circuits allow a smooth variation of the average armature voltage and there is no loss of power at low speeds and no dissipation of energy in the control resistors as in the conventional method of speed control.

Capacitors for SCR commutation

The commutating capacitor is a vital part of SCR circuits. The losses in the capacitor have to be kept as low as possible to maintain high overall efficiency of SCR circuits and to avoid shortened life owing to high internal temperatures. In India, conventional AC/DC general-purpose capacitors have been used for these applications due to non-availability of the specialised components. The very short turn-on times needed for maximum efficiency require capacitors capable of discharging large peak currents up to 1000 amperes in very short periods. These factors make general-purpose capacitors unsuitable for SCR applications.

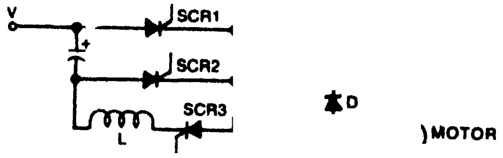

Fig. 4: Chopper circuit for D.C. motor speed control

The use of paper dielectric capacitors in commutation of SCRs has limitations due to increased losses at higher frequencies, which can cause a rapid increase in the dielectric temperature leading to a capacitor breakdown. There is also a point at which the dissipation factor of paper rises with temperature at such a rate that a breakdown is inevitable.

Commutation capacitors need to have a low inductance, a low equivalent series resistance and a high current rating. They need to be vibration proof and may be used in high humidity and temperature conditions. Metallised polycarbonate is the normal dielectric used for these applications due to its high insulation resistance, low power factor and excellent stability. In some applications metallised polyester may be used because even though it is inferior to polycarbonate, it is still greatly superior to paper.

The nature of the voltage, current and frequency applied to commutating capacitors varies greatly with circuits and applications. A degree of individual tailoring of the capacitors to match the circuit requirement is needed and recommended. □

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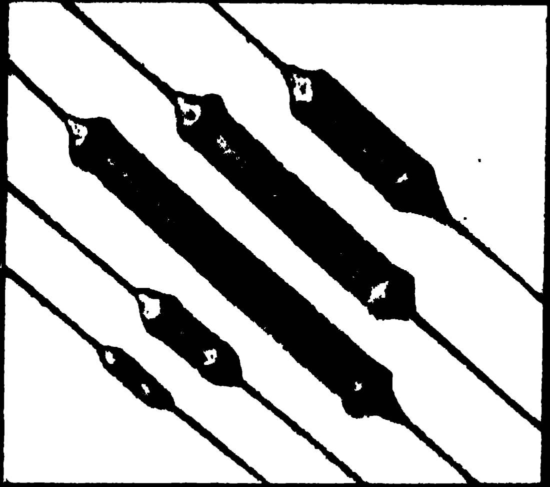

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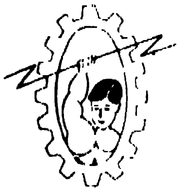

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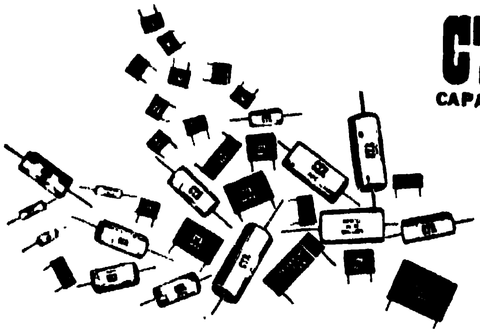

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Pradip Mukhopadhyay

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It consumes very little power when the AC mains supply is available. And, what is equally important, it wastes very little power (which may be measured in milliwatts) in the form of heat when in the conducting state, i.e. when the emergency light's bulb is 'on.' Besides, it is very economical to build as it does not require any costly component.

Working

To understand the operation of the device, let us first consider the circuitry within the dotted box, assuming all other components outside the box to be absent. Resistor R3 biases T1 into conduction, causing a current to flow through R5 Now, as the emitter of T1 is connected directly to the base of T2, all this collector current goes to the base of T2, causing it to be biased in the forward direction too. T2 was off without this base biasing current, but with the introduction of this current T2 comes into conduction and lights up the bulb

The resistors R3 and R5, and the bulb B1, are so chosen that at the stated battery voltage, and with good transistors, both T1 and T2 are driven into saturation. In the saturated state, V_{CE} of transistors is very low. For T1 it is typically around 100mV and for T2 it is about 500mV. The product of $V_{CE\,(Sat)}$ and I_C is equal to the power dissipation in the transistor. For T2, it comes out to be about 180mW. In the worst case, it can be 1.5W (provided, of course, the bulb is not replaced by a thick copper wire).

Now, let us see what happens when the presence of D1 and R2 is also considered. They have as yet no action on the circuitry just described, but they start functioning in the presence of mains voltage (AC only). Resistors R2 and R3 form a potential divider, dropping a fraction of the mains voltage across R3.

Diode D1 rectifies this AC voltage, allowing half-wave pulses through R3. This helps not only to provide a DC voltage to the base of T1, but also saves a lot of power which would otherwise be dissipated in R2 and R3. Capacitor C1 provides a bit of filtering to these half-wave pulses which are now fed to the base of T1. But as T1 is an npn transistor, the negative half-wave pulses only succeed in reverse biasing it. The current that now flows through the collector of T1 is I_{CBO}, and with the transistor chosen, it is much less than 1 µA (typically a few nA). Now, T2 receives no voltage at its base, and the current flowing through its collector-emitter junction is only I_{CEO} For the EC type transistor, it is about 15nA and for the SEM type transistor it was measured to be about 20nA. Clearly, this tiny current cannot light the bulb which therefore remains off. Hence, the total current in the 'off' state is nearly 24nA, giving the off-state impedance of about 250 megohm to the battery. The power dissipations in both the transistors are very low, because of their high resistance values.

However, when the mains voltage across R3 ceases (due to a power-cut or removal of the power chord etc.), the reverse bias to T1 is removed. Due to the charge accumu-

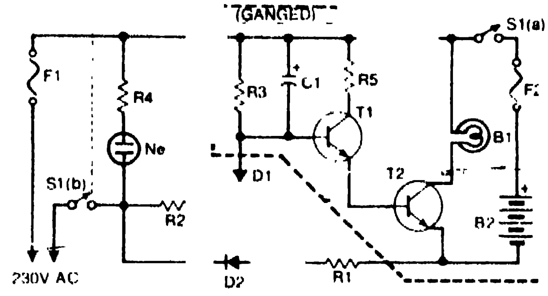

Fig 1· Circuit diagram for the emergency light

PARTS LIST

T1 — CIL147A or BC147A transistor in TO106 mode (CDIL)
T2 — ECN100 (EC) or SL102 (SEM) transistor with a heatsink
C1 — 22 µF, 16V electrolytic capacitor
D1 — EC4001 diode
D2 — EC4006 diode
R1 — 27-kilohm, 1-watt resistor
R2 — 120-kilohm, ½-watt resistor
R3 — 6.8-kilohm, ½-watt resistor
R4 — 270-kilohm, ¼-watt resistor
R5 — 200-ohm, ½-watt resistor
B1 — 3.8V, 300mA bulb (Philips)
B2 — 6V battery (4 cells, 'IR20' or equivalent)
Ne — Wire-ended neon bulb, green
F1 — 100mA } Both glass cartridge type fuses,
F2 — 1A } with their holders
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lated on C1, a slight delay occurs in the bottoming of T1. This is useful, for as soon as T1 is bottomed, T2 is also bottomed in no time (after nearly 0.5 µsec., if not less). But the cold resistance of the filament of B1 is low, and hence a huge amount of surge current flows through the collector of T2. This limits the longevity of the battery and T2 in the long run. Due to the presence of C1, T1 is bottomed a bit slowly (typically 0.5 sec.) and the filament of the bulb has some time to heat up, thereby not drawing too heavy a current.

The purpose of D2 and R1 is to trickle charge B2 to improve its working life. Moreover, the shelf life of B2 is also lengthened (because a load of over 250 megohm is practically an open circuit to B2). The neon bulb (Ne) indicates the presence of mains voltage.

Fuses F1 and F2 are included in the circuit to prevent accidental shortcircuiting or other mishaps. S1 is chosen as a DPDT slide switch, for not only is it very cheap and small, but also two electrically independent sections are available for it. And with it, when the functioning of the light is not required, the gadget is switched off, presenting an impedance of well over 1000 megohm to the battery and the mains. ☐

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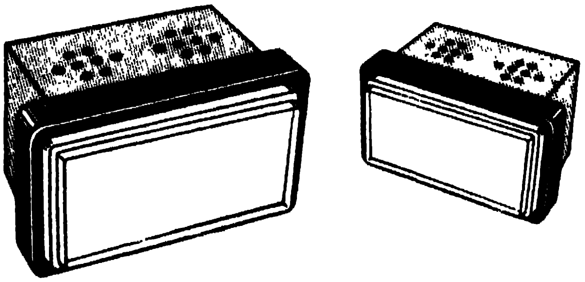

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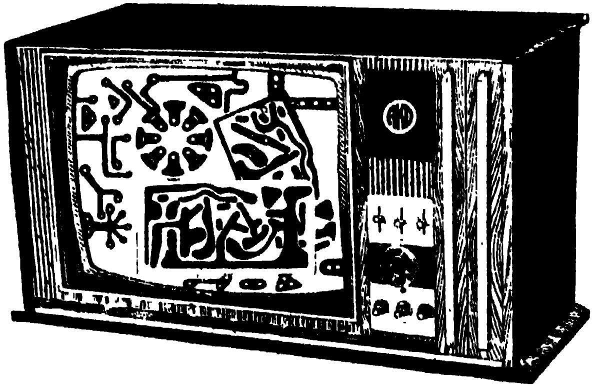

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Electronic Organ

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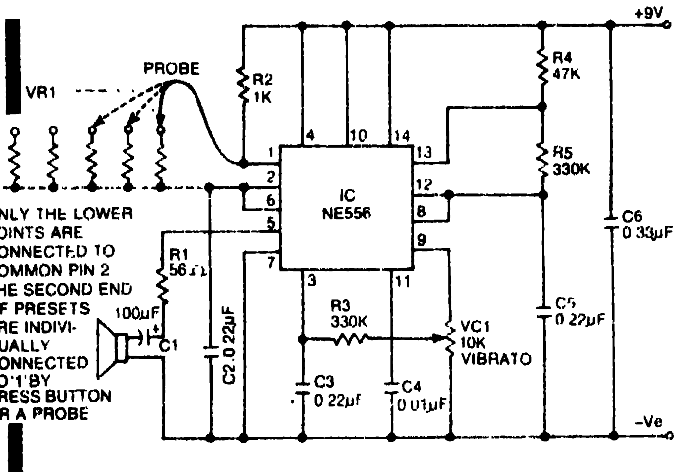

+9V
PROBE
VR1
R2
1K
R4
47K
4
10
14
13
1
2
6
5
7
12
8
9
IC
NE556
R5
330K
C6
0.33µF
ONLY THE LOWER POINTS ARE CONNECTED TO COMMON PIN 2 THE SECOND END OF PRESETS ARE INDIVIDUALLY CONNECTED TO '1' BY PRESS BUTTON OR A PROBE
R1
56Ω
100µF
C1
C2 0.22µF
3
11
R3
330K
VC1
10K
VIBRATO
C5
0.22µF
C3
0.22µF
C4
0.01µF
-Ve

This organ is constructed using IC 556, a dual timer. The timer is connected as two separate multivibrators — a tone oscillator whose frequency depends on the value of resistor used on keyboard, and a vibrato oscillator running at about 10 Hz. For the keyboard, presets are preferable as they can be tuned to an exact tone.

The threshold pin 2 of the IC is connected to the presets on keyboard. Thus the pin numbers 1, 2, 3, 4, 5, 6, 14+ and 7− form one oscillator and rest of the pins form the second oscillator, with R4, R5 and C5 producing a 10Hz square wave at the output pin 9. The output from pin 9 is fed to pin 3 (first oscillator's control voltage pin) via a potentiometer which can give varying depth.

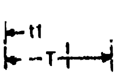
R3 and C3 filter out the higher frequencies produced due to sharp edge of the square wave. R1 limits the output of IC within its capabilities and also reduces battery consumption. C1 blocks the DC voltage from going to speaker. C6 is used for stability against the increase in internal resistance of battery due to aging.

The frequency of first oscillator is given by the formula

$F = 1/T$, where $T = t1 + t2$

$t1 = 0.7 \times (R2 + VR) \times C$

and $t2 = 0.7 \times C$



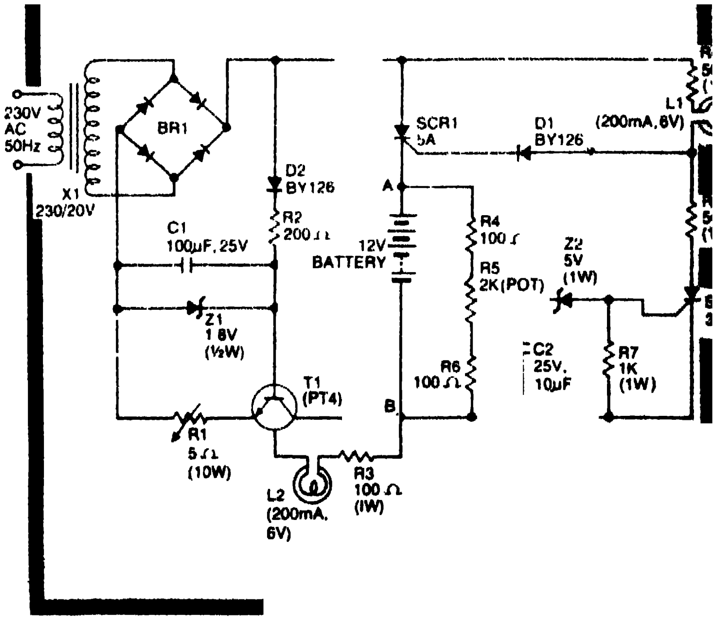
When the probe is touched to any one of the presets, a note is produced. Set the vibrato control to zero and adjust the presets for correct pitch, comparing with a harmonium, piano, a pitch pipe or any other musical instrument.

SUNIL BHANDARI

Self-regulating Battery Charger With Short-circuit Protection

The bridge rectifier BR1 applies a full-wave rectified unfiltered voltage to the battery (12V) through SCR1 (5A). The gate current of SCR1 is obtained through an indicator lamp L1 (200mA, 6V) and diode D1. SCR2 is used for automatically stopping the gating pulses to SCR1 on full charge. The voltage of the battery being charged is monitored by the potential divider R4-R5-R6 which charges C2. When the battery is fully charged, as sensed by R5, C2 has sufficient voltage to break zener Z2, and trigger SCR2.

When SCR2 goes 'on,' indicator lamp L1 lights up giving a visual indication that charging has ceased. Once the charging current ceases, the battery voltage rapidly falls back and triggers SCR1 again with SCR2 'off.' More charging current is applied to the battery.



When the battery is very near to full charge, the decay time rises to such a value that mean current is very much reduced. The decay time becomes so long that SCR1 turns on perhaps only once in every 10 half-cycles and the charging current reduces to a trickle (a few hundred milliamps). Thus the charging current does not fall to zero sharply but reduces very slowly over a period of several hours from full rate to a trickle. The trickle charge is maintained indefinitely.

The power transistor T1 (PT4, 2amp), is used to have a constant current charging. The zener diode Z1 (1.8V) maintains a constant voltage across the base-emitter junction of T1, thus giving a constant collector current which is also the charging current of the battery.

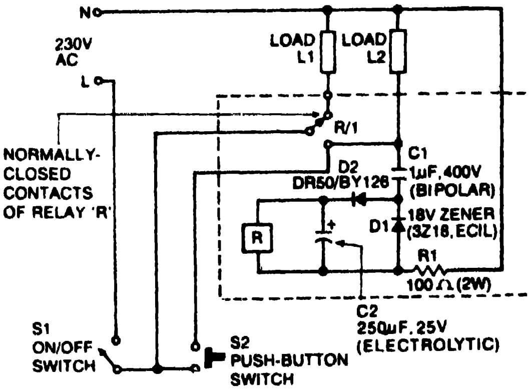
If the terminals 'A' and 'B' are shorted, as would happen if a dead battery is connected, nearly all the voltage appears across the base collector of T1 and none appears across AB. The indicator lamp L2 (200mA, 6V) lights up, indicating a short circuit.

As T1 should dissipate considerable power (about 25 watts, for charging a 12V battery at 2 amps), it must have a good heat sink.

N.O. GUNASEKHAR

Changeover Switch With Built-in Priority

This simple circuit acts as a changeover switch with a fixed priority. When power is switched on, only the first load (L1) is connected, irrespective of initial conditions. Changeover to the second load (L2), which may be a precious gadget requiring protection from switching-on transients, is under your control and can be done only by pressing the push-button switch (S2). The load L1 may just be a dim light bulb or an indicator light.



When AC mains power is switched on through S1, power is applied to load L1 via the normally-closed contacts R/1 of relay R. If S2 is pressed momentarily, power is instantly applied to the load L2 and simultaneously to the electronic circuit.

Components C1, D1, R1, D2 and C2 form the transformerless low-voltage power supply. C1 is the excess voltage dropper. R1 is the initial surge current limiter. D2 rectifies and C2 smoothes the DC output.

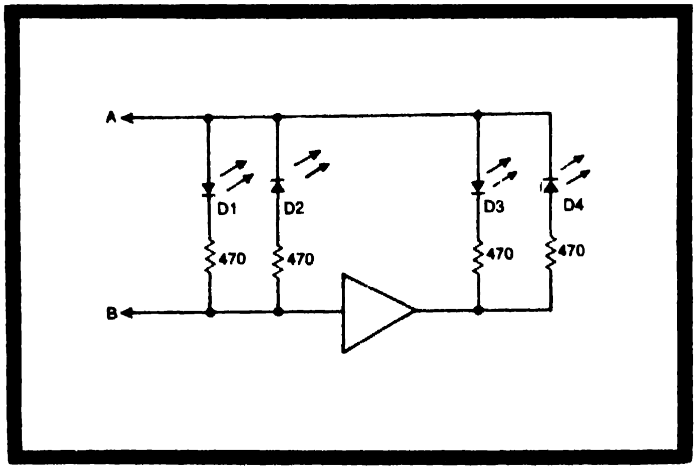
When S2 is pressed, a DC voltage gets applied across the relay R and it operates. The relay's contacts move over to the other position, switching on load L2 and offering an alternative path to the AC current to keep the low-power supply alive. The load L2 will now remain 'on' even if the push-button switch S2 is released.

Now if the AC supply fails, or is switched off through S1, the relay's contacts R/1 will move back to their normally-closed position and get connected to the load L1. If the AC power is switched on again, only the load L1 will switch on. To switch on L2, the push-button S2 will have to be pressed once again.

D VENKATASUBBIAH

Binary State Indicator

Do you want to test any of the digital equipment at home? If yes, here is a simple circuit which will indicate the binary state at any particular point. The circuit uses four LEDs, one inverter and four resistors.



If the two points 'A' and 'B' are at the same level, D1 and D2 will remain off as both the ends of LEDs are at the same level. But D3 and D4 have different levels at their opposite ends because of the inverters. So one of the diodes D3 and D4 (whichever is forward biased) will glow.

In the same way, if points 'A' and 'B' are at different levels, one of the diodes D1 and D2 will glow, indicating the state at the two points.

Resistances in series with the LEDs are to limit the current through the LEDs. Any of the LEDs (of about 20-30mA) may be used.

Inverter used may be a spare gate or transistor. Any one of the gates of IC 7404, 7400 or 7432 may be used; in case of 7400 and 7432, all the inputs of the NAND gates should be shorted.

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EXPORT OF ELECTRONICS GOODS FROM INDIA

R. M. Nayar

It cannot be denied or doubted that electronics, both as a science and as an industry, has been growing extremely rapidly in recent years. The fact that the total world consumption of electronics goods has been estimated to rise from 70 billion dollars to 170 billion dollars during the decade 1970 to 1980 is good enough evidence for anyone who may doubt the rapid progress of electronics.

At present, the electronics industry in India produces goods worth around 600 million dollars every year. This is not a very significant achievement when compared to the progress made by the western countries and Japan. However, it is encouraging to note that the Indian electronics industry has a wide technology base and infrastructure capable of producing sophisticated electronic and communication equipment and systems. These can cater for the needs of users in the defence services, posts and telegraphs departments, railways and in numerous other fields. The industry is now also trying to meet the increasing demands of entertainment electronics.

India has at present more than 100 large and medium-scale electronics factories in addition to over 2,000 small-scale units, altogether employing nearly 200,000 people. Research and development is carried out in 35 national laboratories and in about 100 units specially recognised by the government.

The salient features of any electronics industry, whether Indian or foreign, are low investments, a high potential for employment and scope for the rapid development of a large number of assembly-oriented small-scale firms. Further, electronics can have a catalysing effect in the development of a number of other industries.

The Indian electronics industry has been able to achieve all these benefits. But owing to its concentration on becoming self-reliant in a short period, less attention has been given to exports of electronics items. Concerted efforts are, however, presently being made to enter the world market on a larger scale.

While the entire production of electronics goods in the country is expected to go up from a value of 600 million dollars per year to 5 billion dollars per year in the next 10 to 12 years, exports alone are targeted to increase from the present level of a value of 50 million dollars per year to 250 million dollars in the next five years, and to around 1 billion dollars in 10 years. These targets may, hopefully, be achieved, thanks to two major advantages—the carefully planned and wide-based infrastructure, and the continuous availability of cheap operative labour and highly skilled technical manpower.

Keeping this in mind, many export-oriented production units using modern technology have been set up in recent years. Wherever necessary, the government has permitted the import of knowhow to support such ventures.

At present, the organisations actively involved in improving the image and saleability of Indian electronics goods in foreign markets are the Electronics Trade and Technology Development Corporation (ETTDC), the Trade Development Authority of India, the Engineering Export Promotion Council, and the Santacruz Electronics Export Processing Zone.

Information concerning the Indian electronics industry is also available in the commercial sections of all Indian embassies abroad. Moreover, a number of our young and enthusiastic diplomats are helping to capture markets for Indian electronic items. There is also hardly any international trade fair or exhibition where Indian electronics goods are not displayed. Exclusive electronics buyer-seller meets and technical seminars are also arranged frequently.

The Electronics Trade and Technology Development Corporation is continuously engaged in augmenting the production of better quality electronics goods in India. It is also making all efforts to export entire projects and systems in the communications and allied fields. Consultancy services for setting up exclusive electronic industrial estates are being offered to interested developing countries by the ETTDC. This organisation has already launched a few production programmes which are oriented towards the large-scale export of black-and-white low-cost TV sets, computer memories and components. In addition, a number of techno-commercial export houses are operating on the lines of general trade companies in the Far East. They are engaged in the development of export markets and trade with the support of the government.

At present Indian exports of electronics items range in technology from aerospace radars and electro-mechanical components to low-cost radios. India now hopes to export more sophisticated systems using competitive hardware and software, especially in the communications, instrumentation and computer fields. In addition, there is a good prospect of obtaining large-scale sub-contracts from developed countries for assembly jobs, labour-heavy electro-mechanical components and sub-assemblies.

The Santracruz Electronics Export Processing Zone is sure to play a crucial part in boosting Indian exports of electronics goods in the near future. This free trade zone is now poised for a big leap forward, having gained adequate experience in the past four years. Let us therefore hope that our country will soon secure a large share for itself of the world electronics market.

Mr R.M.Nayar is chairman and managing director, Electronics Trade and Technology Development Corporation Ltd, New Delhi.

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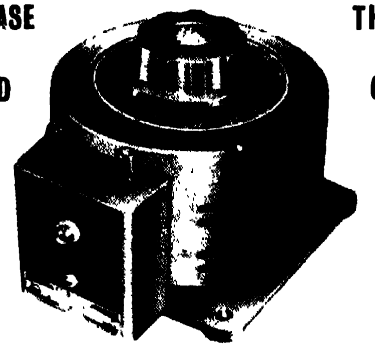

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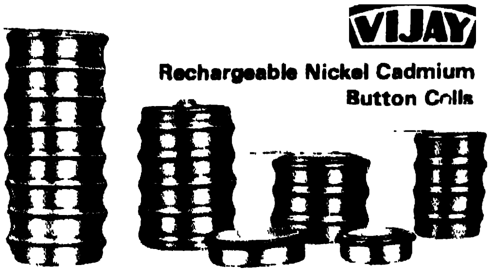

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IM 6100: THE MINICOMPUTER ON A CHIP

A.A. Alvares

Hardware cost limits the use of minicomputers for dedicated applications to systems bearing a price tag of at least $ 10,000 or more. The economies offered by low cost, high performance, commercially available microprocessors have opened up entirely new fields of dedicated computer applications which may not have been feasible or cost effective.

However, presently available microprocessors do not fare well in cost performance trade-off with hardware and software in areas currently dominated by minicomputers. The microprocessor- based system needs extensive software development to enhance its capability and be a useful system design tool. Because of the lack of adequate software support, a microprocessor- based system may require longer development time than minicomputer- based systems. In addition, the need of specialized software, general utility programs, mathematical routines and executive system software can increase the cost and lengthen the system development time by at least an order of magnitude. In order to justify these higher development costs, the microprocessor- based system must have a sufficiently large production volume.

The challenge of bridging the cost/performance gap of minicomputer vs. microprocessor has been met by the performance of a true minicomputer in a unique, single-chip, low-cost microprocessor, the IM6100.

By emulating an existing minicomputer architecture, the IM6100 overcomes many of the problems associated with the current microprocessor technology. The IM6100 is a single-chip, 12-bit, parallel microcomputer which is capable of executing the instruction set of Digital Equipment Corporation's PDP-8 minicomputer. The IM6100 is designed by using state of the art 'silicon gate complementary MOS' technology which offers high packing density with good speed performance, noise immunity and extremely low power dissipation. The internal logic structure is fully static in nature and allows the clock to be stopped between instructions, cycles or minor cycles. In addition, it requires single +5 volt supply. All the signals are fully TTL compatible. The design has been optimised to minimise external packages, thus, reducing the overall system cost in comparison with other microprocessors that require multiple supply voltages and support chips.

The ability of complementary MOS technology to withstand larger variation of supply voltages and temperature range automatically qualifies the IM6100 for military applications, so far ignored by other microprocessor developers.

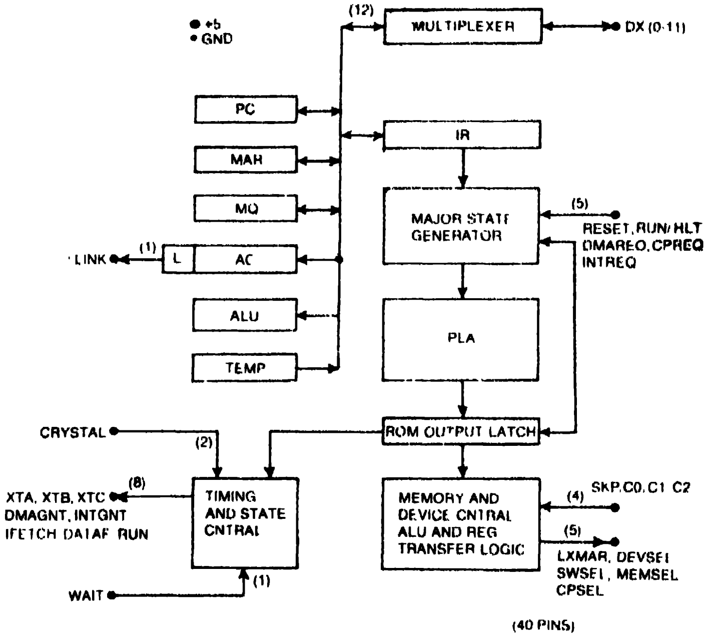


Fig. 1: Functional Block Diagram

The functional block diagram of the IM6100 is shown in Fig. 1. It has six 12-bit registers, a programmable logic array (PLA) to generate control signals, an arithmetic and logic unit (ALU) and timing circuitry.

The 12-bit data bus handles address, data and instruction transfers between the CPU and the memory or the peripheral devices on a time multiplexed basis. All data transfers within the CPU are handled by the internal bidirectional bus. The accumulator (AC) is a 12-bit register in which arithmetic and logical operations are performed. All programmed information transfers between memory and peripheral devices are passed through the accumulator.

As shown in the block diagram, the IM6100 allows two separate pins to connect an external crystal, thus eliminating the need of expensive and cumbersome clock generators or clocking mechanisms. The internal circuitry is designed to operate at any speed between DC and 2 MHz. The internal timing circuitry will divide the crystal frequency by two and provide the base timing of 500ns clock frequency with 50% duty cycle for system operation, with a 4MHz crystal.

The program counter (PC) controls the program sequ-

Mr A.A. Alvares is international products manager, Zenith Electro-Systems Pvt Ltd, Bombay.

ence. It contains the address of the memory location from which the next instruction is fetched. During the instruction fetch, contents of the program counter are transfered to the memory address register. The program counter is normally incremented by one after an instruction fetch. However, the contents of the program counter may be modified by branch instruction. The memory address register (MAR) contains the address of the memory location that is currently selected for reading or writing. The instruction register (IR) contains the instruction that is currently being executed by the CPU. The 12-bit temporary register (TEMP) latches the result of the arithmetic-logic unit before it is sent to the destination register to avoid race conditions. Link is used as a carry flip-flop for 2's complement arithmetic; a carry out of accumulator complements the link. The link may be rotated as a part of the accumulator and can be cleared, set, complemented and tested under the program control. The multiplier quotient register (MQ) is a program accessible register for temporary data storage. MAR, IR and TEMP are also used as internal registers for microprogram control.

During an instruction fetch, the instruction to be executed is loaded into the instruction register. The PLA is used for correct sequencing of the CPU for the appropriate instruction. Once an instruction is executed, the major state generator scans the various request lines through an internal priority network. The state of the priority network decides whether the machine is going to fetch the next instruction in sequence of service one of the request lines.

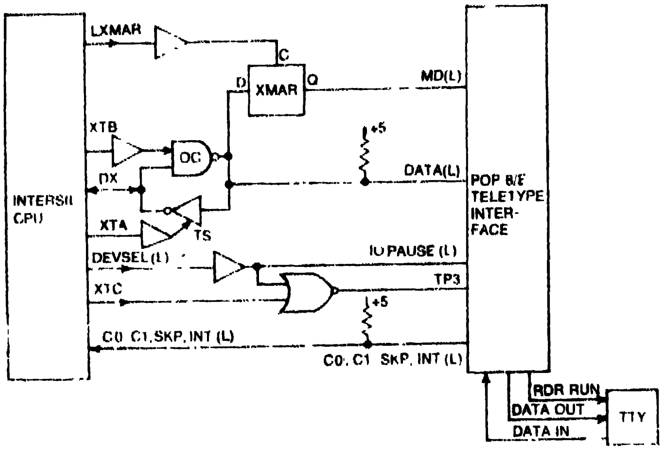


Fig. 2 CPU/CMOS RAM Interface

Fig. 2 describes the interface between CMOS memory and the IM6100. One may observe that the IM6100 is architectured to minimize the external circuitry to interface with memory and peripheral devices. All basic timing and control signals are produced by the processor. Slow memory and peripheral devices may be conveniently interfaced by using the WAIT signal.

The interrupt structure of the IM6100 is compatible with that of the PSP-8. The memory handling capacity of the IM6100 is also compatible with PDP-8. It can address up to 4k of basic memory directly. The memory capacity can be expanded up to 32k by external hardware. The IM6100 will require 5 microseconds to add two 12-bit words as compared to 3 microseconds for a PDP-8. The IM6100 has a 1-cycle direct memory access (DMA) similar to other microprocessors.

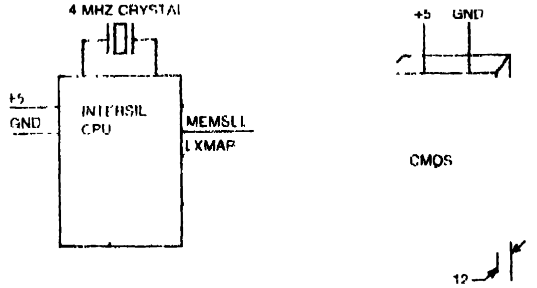


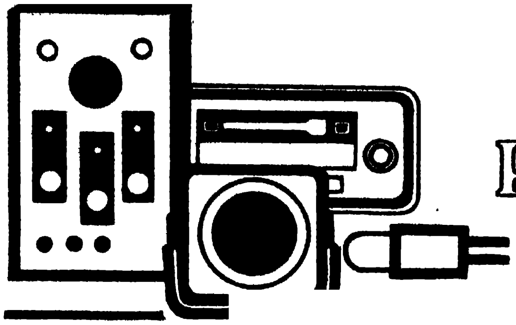
Fig. 3 Example of a PDP 8/ E Programmed I/ O Peripheral Interface

As shown in Fig. 3, the IM6100 interfaces conveniently with PDP-8 compatible programmed I/O peripherals such as teletype, papertape reader, papertape punch, etc.

DEC's PDP-8 has perhaps the most well-known machine organisation and instruction set with more software support than any existing minicomputer system. A microcomputer architectured similar to the PDP-8 is immediately recognisable and immediately usable in most applications. Since system designers are already familiar with conventional minicomputer hardware, they can develop new systems around the IM6100 with a minimum of time and effort and still realise clean, economical and elegant solutions to digital design problems.

The microcomputer technology has evolved around 4/8 (single-chip) or 16 (multi-chip) bit machines. The IM6100 is the first microprocessor incorporating a 12-bit CPU on one chip. The currently available 4/8-bit machines, though adequate for many applications as far as the word length is concerned, have awkward and time consuming memory reference instructions. There are many applications in which one must resort to double precision arithmetic in 8-bit machines to achieve the desired numerical accuracy. A 12-bit machine provides straight forward memory referencing and sufficient numerical accuracy without the correspondingly large memory overhead associated with the 16-bit architectures.

In summary, since the IM6100 utilises the complementary MOS technology and recognises the popular minicomputer instruction set, it will enable the innovative system designer to implement microcomputer based systems including battery-operated and portable systems, economically and with considerably less design time. ☐



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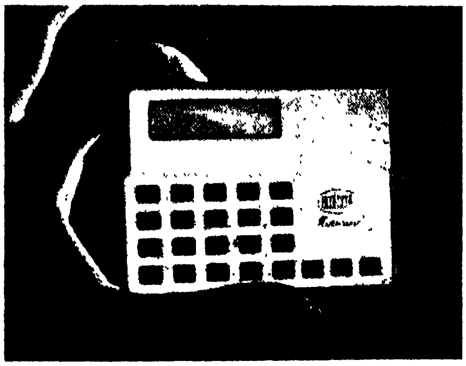
The calculator is powered by two easily available, 1.5V, silver oxide button cells which last for 1000 hours.

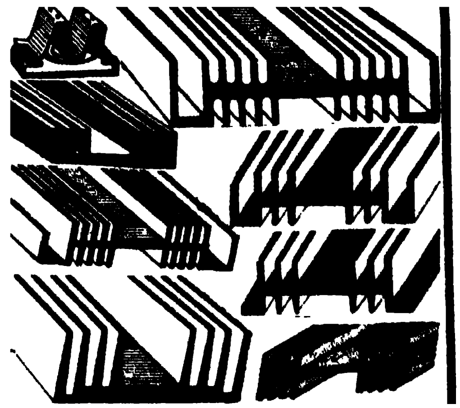


Contact: Marketing Department (Electronics), Advani-Oerlikon Limited, Ador House, 6 K. Dubash Marg, Bombay 400023.

HEAT SINKS

The aluminium alloy 6063-T6 extruded heat sinks are available in a wide range for high, medium and low-power transistors. Heat sinks for low-power transistors to be mounted on printed circuit boards are also available.

Due to good thermal conductivity, the performance of these extruded heat sinks is much better than that of cast heat sinks.

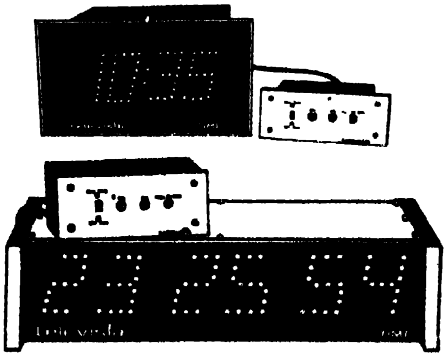


Contact: Jain Electronics, F-37 Nand-dham Industrial Estate, Marol, Bombay 400059.

DIGITAL CLOCKS

Televista has started making digital clocks with large LED displays readable from long distances. The clocks are crystal controlled and provide battery back-up in case of power failure

The clocks, available in various sizes, display time in hours and minutes in 12 hrs/24 hrs format, or in hours, minutes and seconds mode. Day/date calendar facility along with alarm is available.



Master/slave clock system is also available.

Contact: Televista Electronics Pvt Ltd, 239 Okhla Industrial Estate, New Delhi 110020.

ELECTROCARDIOGRAPH

The Cardel 2200 series electrocardiograph is completely portable. Housed in an unbreakable fire-retardant moulded case, it operates on its own rechargeable batteries and on AC mains. It can, in field emergency situations, operate on a car battery or a flashlight cell also.

Since it is modular in construction, only the affected module need be sent for repairs while the user continues to operate the instrument with a service module.

The Cardel 2200 has provision for cardioscope input as well as output and, therefore, can be used as a standby recording unit in an ICCU or to drive a slave monitor. It can be provided with protection from defibrillator and, when equipped in this manner, can go on to a crash cart for emergency cardiac care.

The Cardel 2200, which is the basic 5-lead electrocardiograph, has three other variants.

Contact: Hyderabad Electronic Instruments Ltd, D99, 100 & 101 Industrial Development Area, Jeedimetla, Hyderabad 500854.

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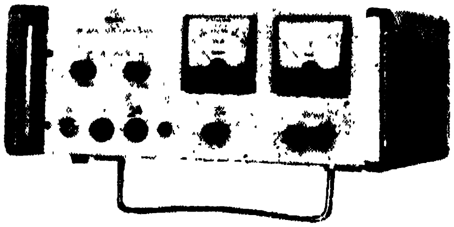
REGULATED POWER SUPPLY

Vaiseshika has developed this power supply in technical collaboration with the Electronics Testing and Development Centre, Chandigarh.

It provides 0 to 30V DC continuously variable voltage and 0 to 2A DC continuously variable current. The load and line regulations are 0.01%. The power supply is designed to operate at a temperature of up to 40°C and relative humidity up to 85°C R.H.



Contact: Vaiseshika Electron Devices, P.B. 57, Ambala Cantt 133001.

HEAT SENSOR

It is a solidstate semiconductor device which energises an alarm when the temperature at the installed area reaches a predetermined critical level.

It operates on 12V DC power supply and can cover a floor area of about 20 sq. metres. For protection of larger areas, the sensors may be installed 20 metres apart.

Contact: Subtronics, Kaliandas Udyog Bhavan, 147 Near Century Bazar, Worli, Bombay 400025.

EMERGENCY LIGHT

The EMER-LIGHT is an emergency light with rechargeable Ni-Cd batteries.

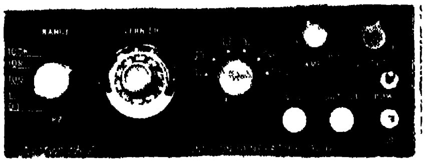
It thus avoids the maintenance cost of wet batteries, and also saves the replacing of discharged dry cells.

The unit is equipped with a solidstate charger with an automatic on-off arrangement. The charger also protects the Ni-Cd batteries from over-charging as well as over-discharging.

Contact: Janta Electronics, 141-A, 1st Chopasni Road, Jodhpur 342003.

FUNCTION GENERATOR

The Networks function generator model 8004 has an external Vco/FM modulation facility which is highly linear and better than 0.1%. Use of 10-turn helical pot gives dial linearity better than ± 0.5%. Thus this function generator can be used as a synthesizer as well as for calibrating and checking linearity of oscilloscope sweep.



It gives six output waveforms (sine, square, triangle, positive and negative pulse, and ramp) at a frequency range of 0.001 Hz to 100 kHz.

Contact: Networks Private Limited, 2 & 4 Uptron Estate, Panki, Kanpur.

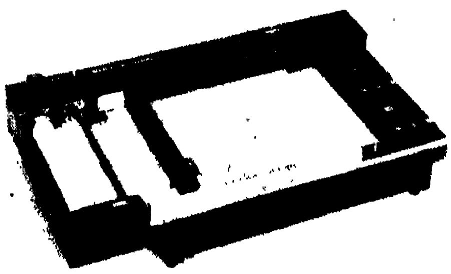
CHART TRANSPORT UNIT

A new chart transport unit from Philips allows the company's A4-format X-Y recorders to be used in fully automatic and remote-controlled measuring systems such as repetitive sample testing or as ordinary Y-t recorders.

The PM 9885 chart transport unit can be preset for 10 different chart speeds from 3 cm/h to 1 cm/s by panel-mounted controls. An automatic stop facility is provided by a mark sensor which can detect printed black stops on each A4 chart sheet.

Remote control is through a standard rear connector and permits fully automatic operation including chart speed, start/stop and frameshift.

Contact: Philips India Ltd, S&I Department, Shivsagar Estate, Block 'A', Dr Annie Besant Road, Worli, Bombay 400018.

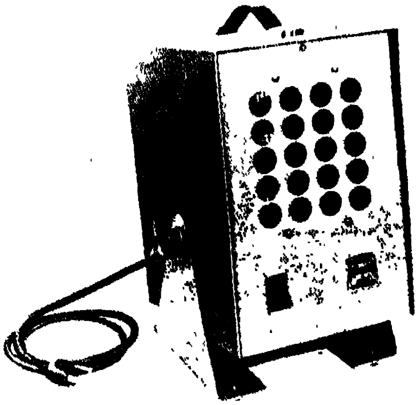


STATIC ELIMINATOR

Static charge, an assemblyman's nightmare, especially to those who put together sensitive devices and electronic components, can now be contained with the SIMCO aerostat portable ionizing air blower. It weighs only 7.5 kg and is about the size of a portable TV set.

The aerostat directs a steady stream of ionised air over a work surface or assembly area that neutralises static charges. Static charges are not only potentially ruinous to certain parts and materials, but they also attract dust and other debris. This contamination becomes trapped in spray painting or plating applications.

Self-contained, the portable static eliminator consists of a blower and static bars that ionise the air current as it is being generated. The unit has an adjustable tilt-stand that allows ionised air flow to be directed precisely on the area or subjects where static elimination is desired.



Contact: SIMCO (Nederland) B.V., P.O. Box 11, Lochem, Holland.

COMPANY PROFILES

ETTDC Shows Good Results

Electronics Trade and Technology Development Corporation Ltd (ETTDC) achieved a turnover of Rs 115 million, including exports, during the financial year ended July 31, 1978. Its turnover during the preceding year was Rs 65 million.

Exports during 1977-78 were also much higher at Rs 12.8 million as compared to Rs 5.1 million for 1976-77.

Mr R. M. Nayar, the corporation's chairman and managing director, presented a cheque of Rs 300,000 toward dividend for the year 1977-78 to Prof. B. Nag, secretary, Department of Electronics, when he visited the exhibition of electronic items being developed and exported by ETTDC. The corporation's profit before tax for the year ended July 31, 1978 was Rs 5.1 million.

ETTDC has set up a target of Rs 150 million for turnover during the current year, with exports contributing about Rs 20 million. The corporation has export orders worth over Rs 200 million in hand for TV sets, computer memories and components which will take about four years to be converted to production and supplies. For this purpose it has already initiated three joint-sector projects, according to Mr Nayar.

In the exhibition held at its head office in New Delhi, ETTDC displayed a computerised sub-titling system for cinema and TV. It has also developed a low-cost 2-band radio for rural markets and a telephone receiver which promises a superior performance over those being currently made in India.

The technology development projects taken up by ETTDC are export-oriented, though in some cases of sophisticated professional equipment like small computing systems, marketing will be done in India also for import-substitution.

Besides the two canalised items—TV picture tubes and calculator chips—ETTDC now offers 88 items for 'off-the-shelf' delivery to actual users against import licences and stock-and-sale schemes.

Sapphire Innovators to Distribute MDB Computer Products

MDB Systems Inc., a leading manufacturer of computer interface products in USA has appointed Sapphire Innovators Pvt Ltd as the distributor for its products in India.

According to Mr Gene Sylvester, director of marketing for MDB Systems, Sapphire Innovators will be exclusively responsible for sales, marketing and customer assistance and will also maintain an inventory of high-demand MDB interface products.

MDB Systems is today well known in the international market as the manufacturer of peripheral device controllers, general-purpose logic modules, communications/ terminal modules and systems modules—the result, no doubt, of appointing distributors in every part of the world.

Its products are plug-compatible and software transparent to both the host computer as well as the peripheral equipment.

Solid State Devices Enters the Capital Market

Solid State Devices India entered the capital market on March 5. It offered 583,000 equity shares of Rs 10 each. The issue, which was fully underwritten, was made to finance partly the Rs 33.5 million project to be set up at Pattancherevu Medak district (Andhra Pradesh) to manufacture five million semiconductor devices every year.

This is a joint venture by Andhra Pradesh Industrial Development Corporation (APIDC) and Yamuna Digital Electronics (Private) Ltd.

APIDC will subscribe the equity capital up to Rs 3.094 million; private promoters will subscribe Rs 2.975 million. To cover up the need for the remaining funds, term loans of the value of Rs 20.1 million have been sought. The centre will give a subsidy of Rs 1.5 million.

A part of the machinery and plant will be produced within the country while the rest will be imported from the USA. The company is confident of installing the entire machinery by the end of the current month. Trial runs will be started in April. If all goes well, the unit will be in full production in May this year.

ITI's Ambitious Programme for Communication Lines

Indian Telephone Industries Ltd, a public sector undertaking, has plans to embark on an ambitious programme of installing 8000 to 9000 new internal communication lines in the western region during 1979-80.

The western region office of this undertaking caters for prospective customers in Maharashtra, Gujarat, Goa and part of Madhya Pradesh. During the first 10 months of this year (1978-79), it has already installed as many as 5,850 lines as against 5,000 lines in 1977-78. The current year's target for this region is installation of 6,000 new lines.

FACTS & FIGURES

LICENCES AND LETTERS OF INTENT

The following licences and letters of intent were issued to electronics firms under the Industries (Development and Regulation) Act, 1951 during the month of December 1978.

Name & address of the applicant and location of the undertaking (1)	*Date & type of licence* (2)	*Article* (3)	*Quantity per annum* (4)
LICENCES			
Punjab Display Devices Ltd, (Subsidiary of Punjab State Industrial Development Corporation Ltd), A-27, Phase-VII, S.A.S. Nagar 166051, Near Chandigarh, Punjab. (Ropar-Punjab)	1.12.78 (NA)	TV picture tubes	40, 000 nos.
Westinghouse Saxby Farmer Ltd, 17 Convent Road, Entally, Calcutta 700014. (Calcutta-West Bengal)	15.12.78 (NA)	Central despatcher system and its sub-systems	100 nos.
The Project Director, Semi-conductor Complex, C/o Tata Institute of Fundamental Research, Homi Bhaba Road, Bombay 400005. (Ropar-Punjab)	20.12.78 (NU)	1. Bipolar/MOS large scale integrated circuit (LSIs) such as chips for calculators, watches, memories, microprocessors, interface circuits and circuits for instrumentation and communication	250,000 nos.
		2. Light emitting diodes (LEDs)	
		(a) Digits	700,000 nos.
		(b) Lamps	200,000 nos.
LETTERS OF INTENT			
Prof. Kanwal Narain Vaid, 307 Ashish Indl Estate, Gokhale Road, Dadar, Bombay 400025. (Uttar Pradesh)	8.12.78 (NU)	1. Magnetic recording tape	80 MRM (of 62.5 mm width)
		2. Magnetic video tape	10 MRM
		3. Magnetic tape for professional use, such as computers	10 MRM
Toshniwal Industries (Pvt) Ltd, Industrial Estate, Makhupura, Ajmer 305002. (Ajmer-Rajasthan)	21.12.78 (NA)	1. Electronic controllers for two-position, three position and continuous control	2,000 nos.
		2. Electro/pneumatic signal converters	1,000 nos.
		3. Transducers and transmitters for temperature and DC variables	500 nos.
U.P. Electronics Corporation Ltd, 4 Prag Narain Road, Lucknow 226001. (Ghaziabad-Uttar Pradesh)	30.12.78 (NU)	1. Long-life aluminium electrolytic capacitors	1.85 million nos.
		2. Long-life polystyrene capacitors	1.85 million nos.
Punjab State Electronics Development & Production Corporation Ltd, Bank of India Bldg, 2nd Floor, Bank Square, Sector 17, Chandigarh. (Ropar-Punjab)	30.12.78 (NU)	Tantalum capacitors (all types)	2.5 million nos.
Usha Electronics, 2 Anand Lok, New Delhi 110049 (Faridabad-Haryana)	30.12.78 (SE)	Plastic film capacitors	20 million nos. (addl) 30 million nos. (after expn)

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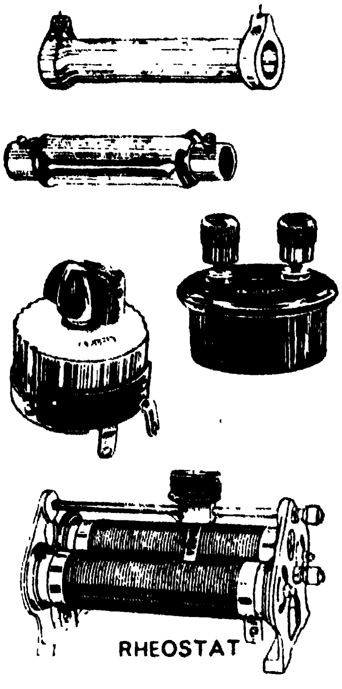

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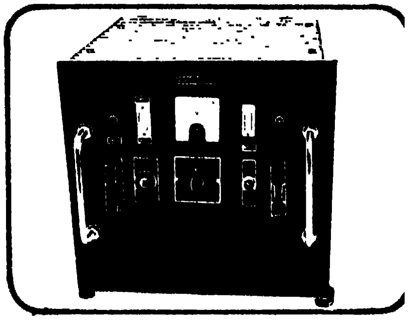

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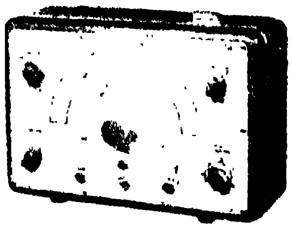

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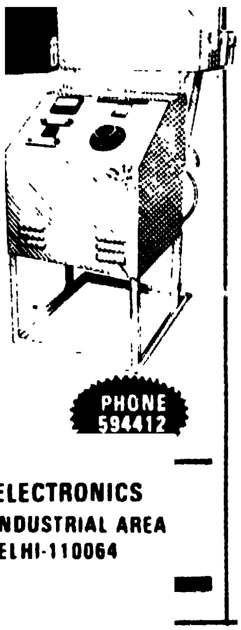

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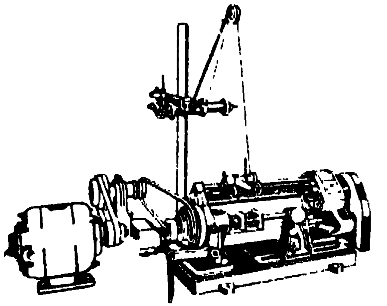

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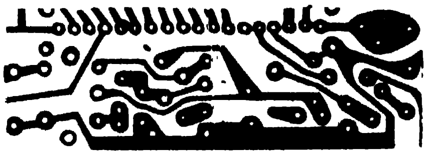

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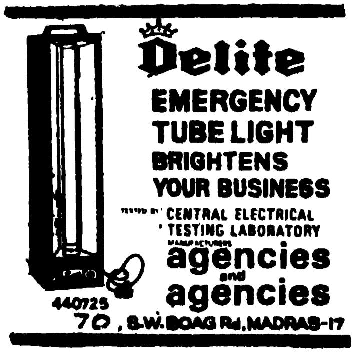

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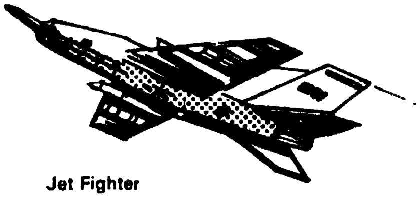

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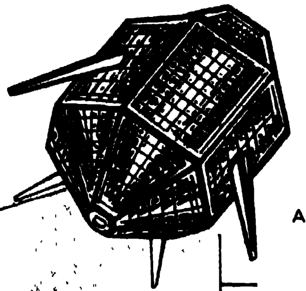

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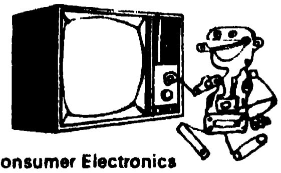

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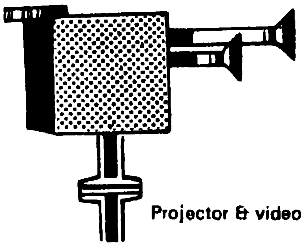

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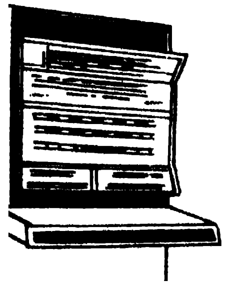

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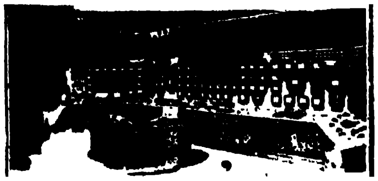

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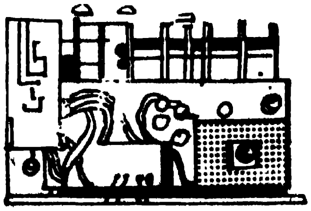

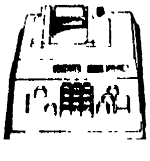

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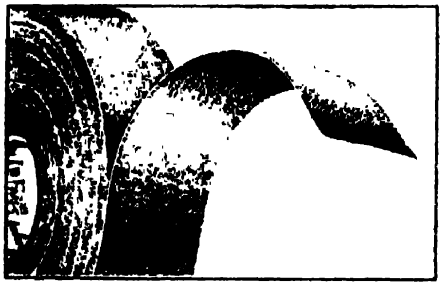

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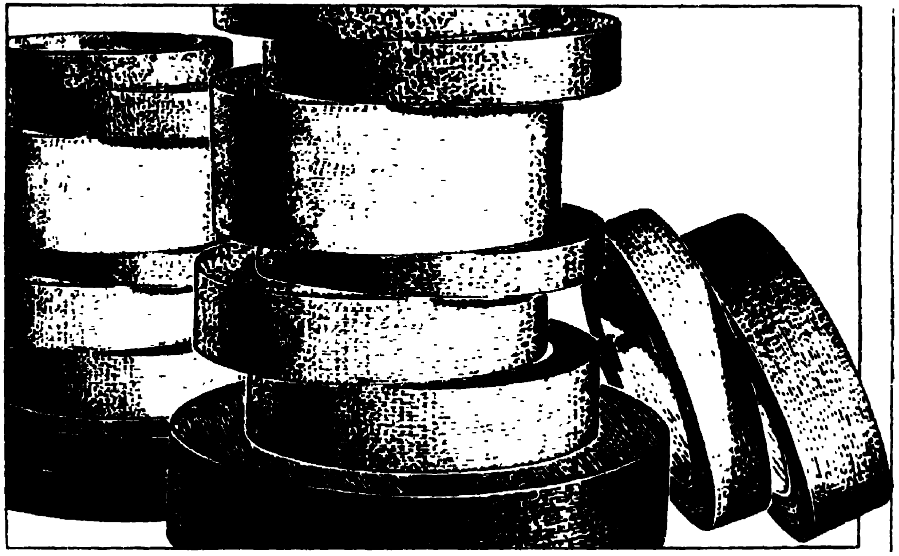

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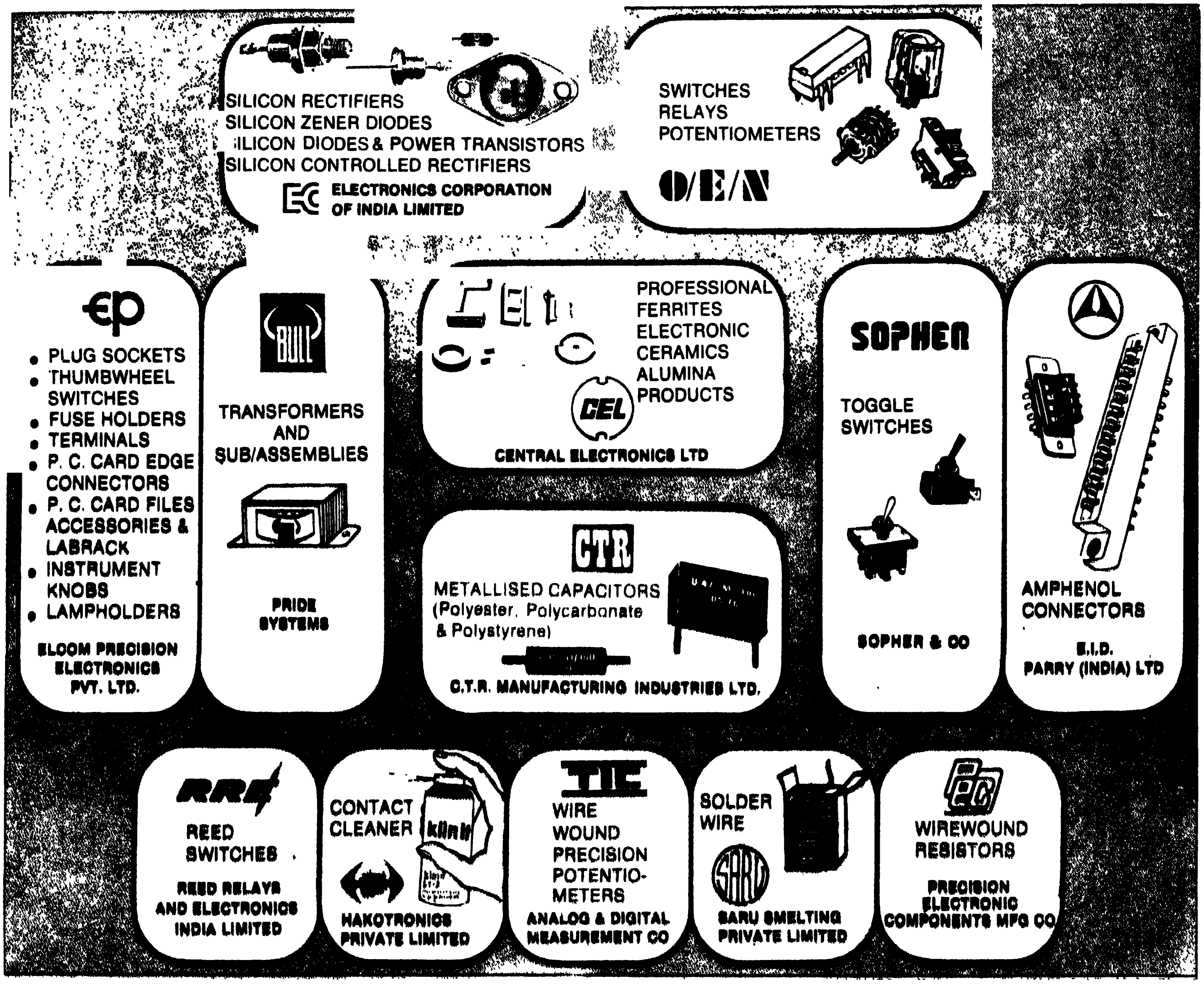

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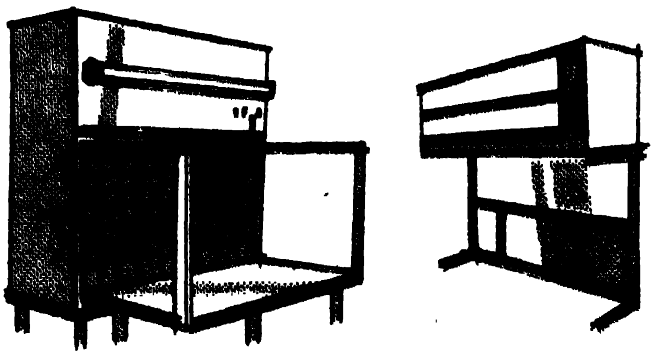

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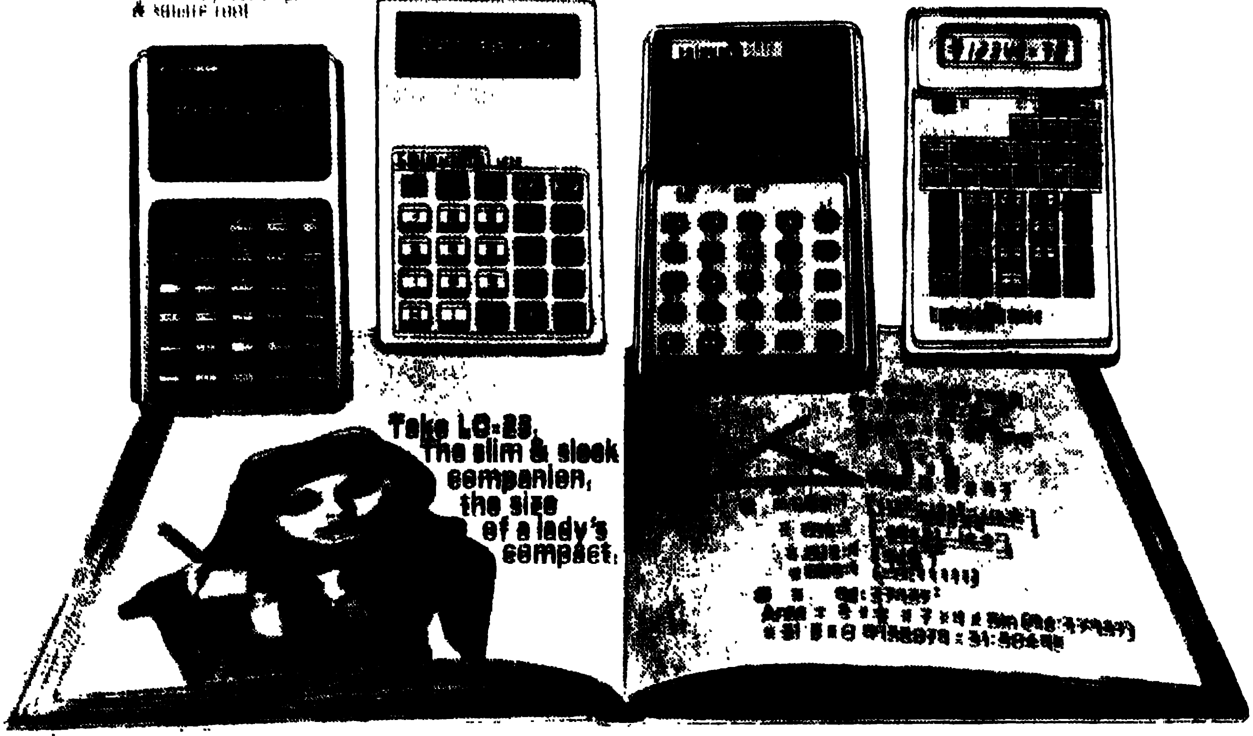

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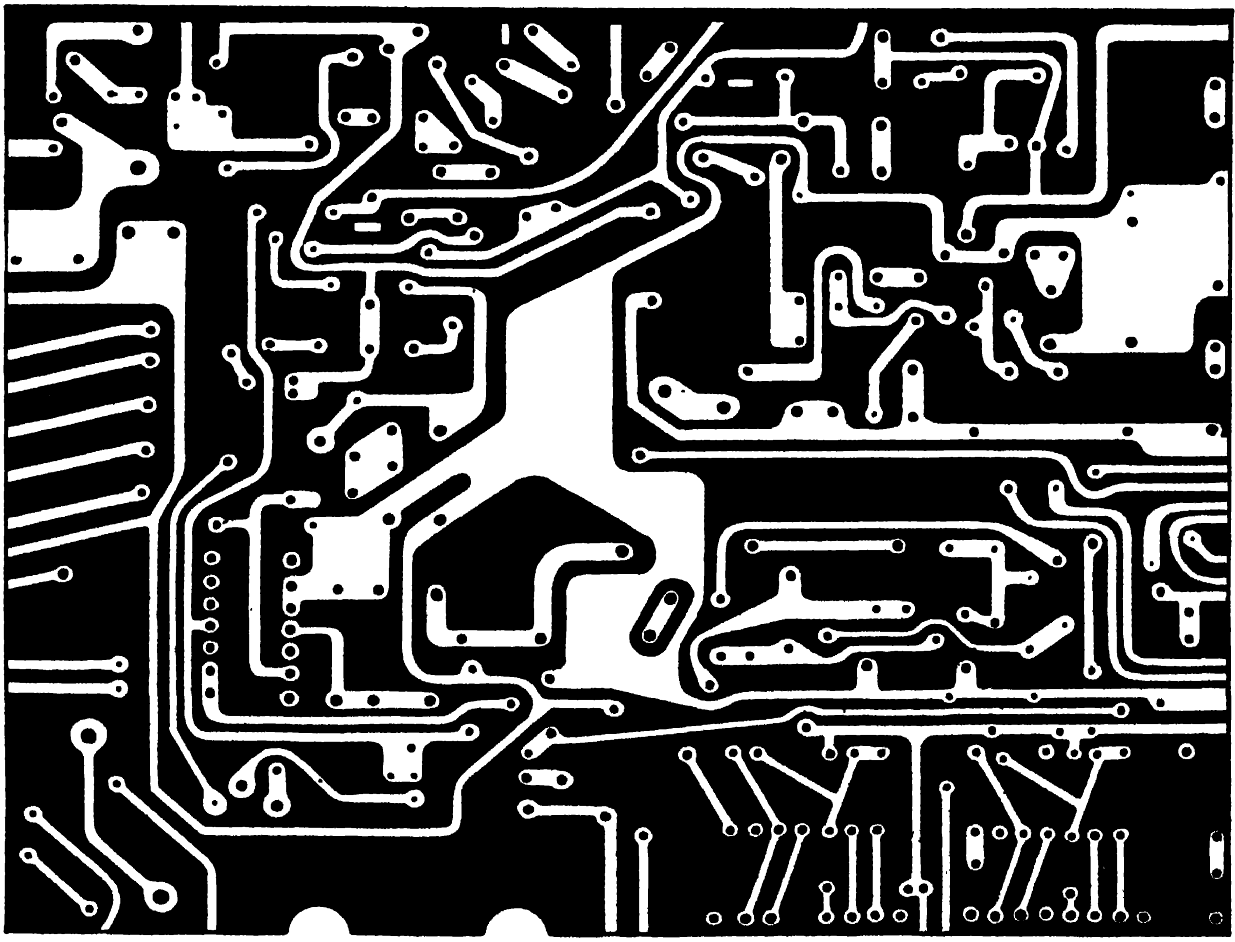

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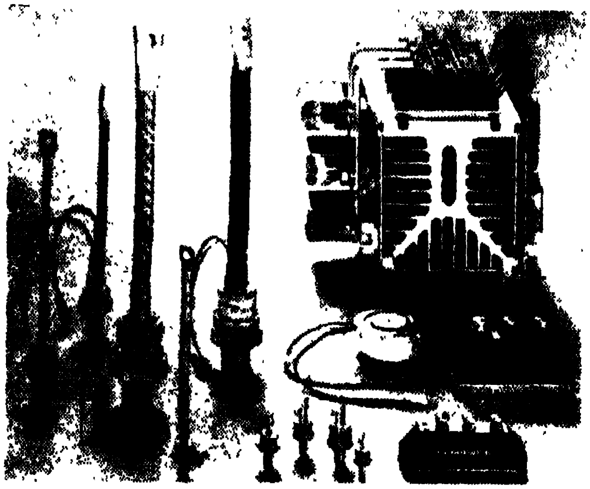

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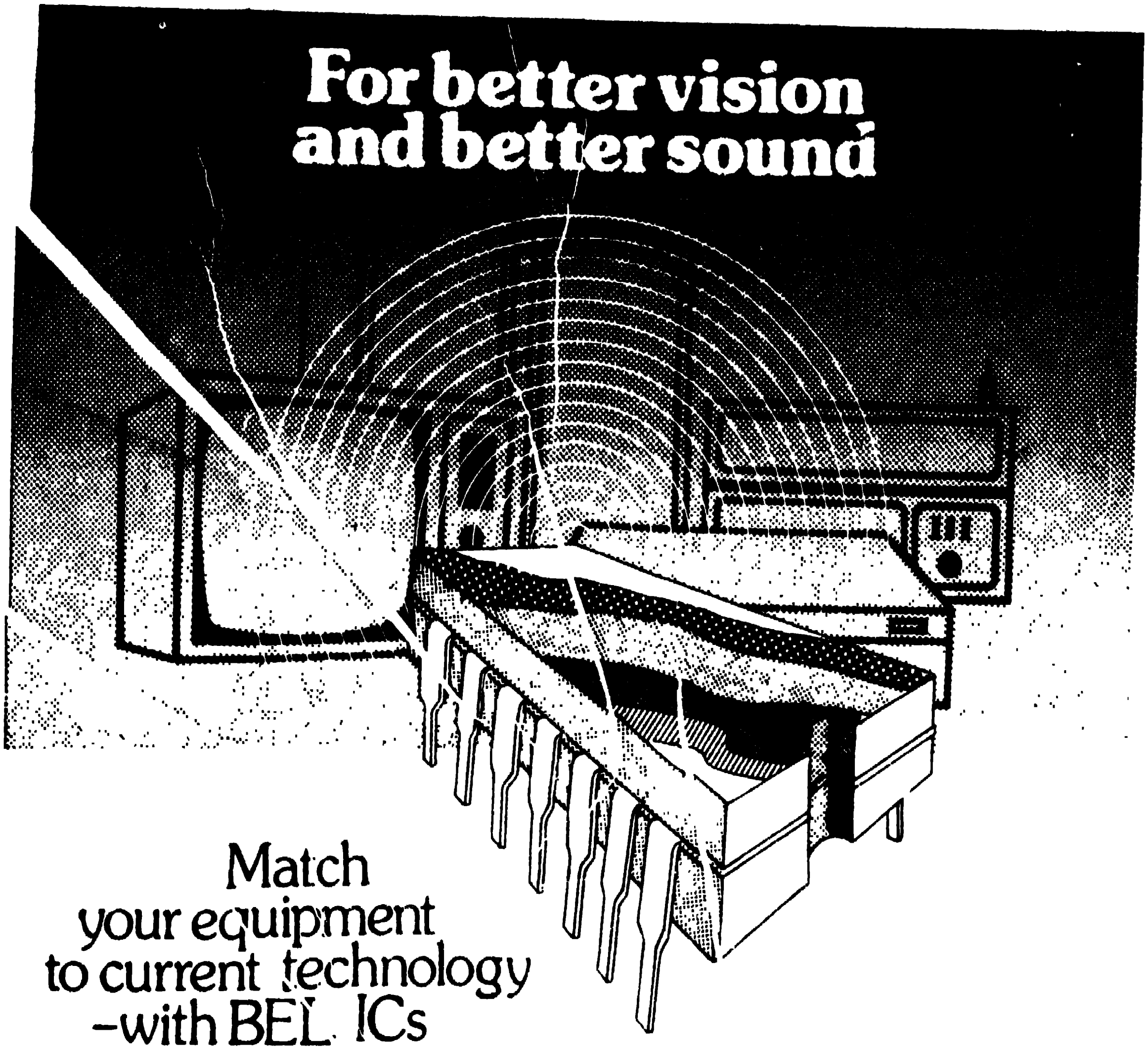

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EDITORIAL

LONG-WAVE BAND: A HARD CHOICE

Our country has at present 129 medium and shortwave radio transmitters which neither cover all the population nor all the area. Even the addition of the proposed 22 transmitters in the rolling five-year Plan for the period 1978-79 to 1982-83 will not cover the entire population or area. It has been suggested that this objective should be achieved by the setting up of three 1000kW long-wave transmitters along with a synchronised national channel. The question that might be asked is: Why did this country not go in for long-wave transmitters in the first instance?

It was in 1947 that the World Administrative Radio Conference (WARC) was held at Atlantic City (USA), and it was at this conference that radio bands were defined and allocated to specific geographical divisions of the world. Only minor revisions were made in the WARC in 1959. The long-wave broadcasting band was allocated to Europe and Africa only. The feeling prevailed at that time that long-wave radio frequencies would encounter interference in tropical regions.

Since 1958, the All India Radio (AIR) has been conducting research on long-wave radio frequencies for broadcasting in tropical conditions. Under the guidance of Mr S.N. Mitra, chief engineer of AIR, it has been demonstrated that long-wave transmission gives a larger audience service area for the same power of transmitter. It has, therefore, been suggested that our country should seek to obtain at least three long-wave broadcasting frequencies at the WARC to be held in Geneva in the month of September this year, since it has been established by the AIR research team that the use of long-wave broadcasting is feasible in the region.

But the switchover is not that simple. It will need to be worked out in a systematic manner, and some of the hurdles will need to be eliminated.

For instance, the long-wave frequencies are currently being used by civil and defence air services, and also by the naval services. The Central Electricity Authority uses long-wave frequencies for its power-line monitoring transmissions for detection of faults and also for the protection of lines and equipment throughout its high-tension work. Alternative arrangements will have to be made for them, and their cost will be of no mean order.

The existing radio sets in use will need minor alterations. There are more than 18 million radio sets in use in our country. Even if the alteration of each set is to cost Rs 25, the liability is likely to run into millions of rupees. In a poor country like ours, is it justified to put such a burden on the radio-owning public?

The next World Administrative Radio Conference will be held in 1999—the last year of the current century. If we do not fight to obtain the long-wave bands for our transmitting stations at Geneva this year, we will have to wait for them for at least 20 years. Moreover, the switchover will not be swift. It will take at least 10 years to make the long-wave bands fully operative. During this period, both the problems listed above could be sorted out. This is the view of the AIR.

The debate on this question has been conducted for months together in the corridors of the concerned ministries in New Delhi. The Ministry of Communications has been asked to provide an overall view of the pros and cons of the proposal. The Department of Electronics has also been consulted on this question.

This is a question which does not offer an easy or satisfactory solution for all concerned. The entry of long-wave bands is bound to hurt quite a few groups in one way or the other. If the multiplicity of stations can be reduced by long-wave transmitting stations and the whole nation can be bound together by a single national radio broadcast channel, then the choice offered is indeed attractive—but the price to be paid is not small.

Understandably, the experts are at loggerheads and there is every possibility that the issue will be taken to the cabinet. If that should happen, then the decision can be forecast. The Ministry of Finance which has always treated radio and television as a luxury (vide the proposals in the latest budget), will sway the argument in favour of *status quo* and the country will have to take up this question seriously 20 years later.

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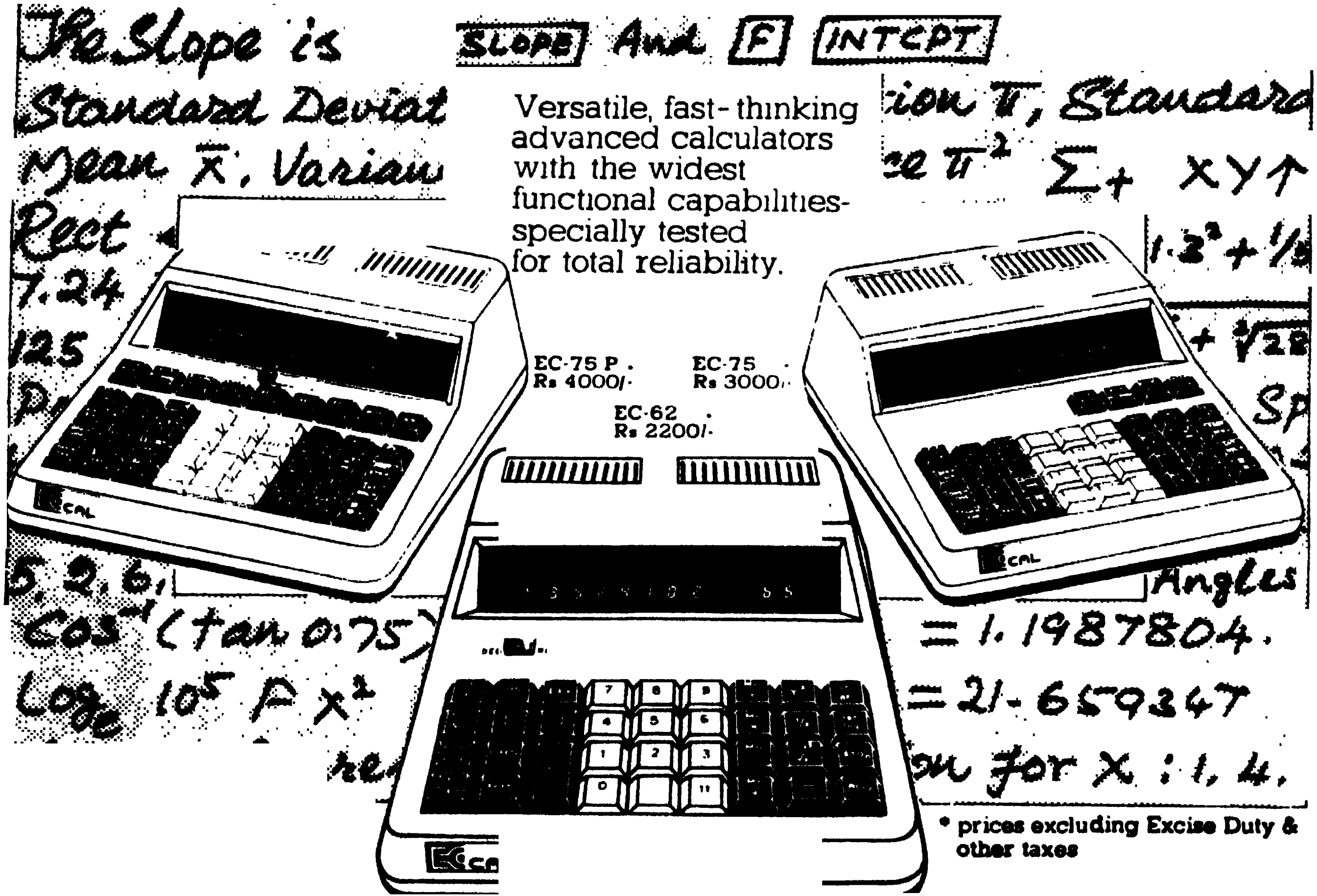

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WHAT'S NEW

In India ...

Electronics Goods Worth Rs 6000 Million Produced in 1978

Electronics production has grown at an average annual rate of over 20 per cent during the last few years, and the value of production in 1978 is estimated at Rs 6000 million. This was disclosed in a written reply to a question in the Lok Sabha on February 28, 1979. Figures for the previous years are—1975: 3645 million; 1976: Rs 4100 million; and 1977: Rs 5080 million.

Under a comprehensive plan for the development of the industry, the production is likely to increase to a level of about Rs 12,000 million by 1982-83, the end of the Sixth Plan period.

Electronics products made in India are being exported to about 50 countries, including the USA. The value of electronic exports during 1978-79 is estimated to be about Rs 400 million. Studies have been made by the Electronics Commission to explore the export potential of electronics products in international markets. The Electronics Trade and Technology Development Corporation (ETTDC), a public sector company of the Department of Electronics, has been assisting a number of units in the export of their products. Bharat Electronics Limited (BEL) has won large export orders for professional electronics equipment, such as communication and radar equipment, while Instrumentation Limited has won several export orders for process control instrumentation and computer-based data acquisition systems in Malaysia.

Sondhi Report is Delayed

The Sondhi committee was set up last year on December 7, to give a new direction to the electronics industry in this country. According to newspaper reports, the work of this committee has been hampered due to lack of cooperation from main manufacturers of electronics goods and the paucity of secretariat staff.

Even if the report is submitted to the government of India in May-June this year—the committee having sought extension of time to finalise the report—it would take a long time before its recommendations are accepted. The usual 'processing' of the report is expected to delay its implementation.

The industry is understandably disturbed because pending finalisation of the Sondhi report and its acceptance or rejection by the Government, the task of issuing new letters of intent and licences has come to a virtual stop.

Delhi TV to be Linked With Bombay TV

The Bombay-Delhi wideband microwave links are expected to be handed over by the Posts and Telegraphs Department to Doordarshan for use during this year. Delhi-Calcutta links will be set up next year. The relay of television programmes among the metropolitan cities of Delhi, Calcutta and Bombay will be possible when the wideband microwave linkage of these cities is established. This information was given in the Rajya Sabha by Mr L. K. Advani, the Central Minister for Information and Broadcasting, on March 5, 1979.

Expenditure on Computer Imports

The government had approved the import of computers worth about Rs 160 million for the nine-month period ending on December 31, 1978. This information was given by the Prime Minister, Mr Morarji Desai, in the Lok Sabha on March 7,1979.

The imports related to new computer systems to replace older ones valued at Rs 125 million; the balance was for new projects. The import of computers is allowed only in cases where indigenous systems cannot meet identified user requirements.

In reply to another question, the Prime Minister said that of the 47 enquiries for the import of 86 computer systems received by the government, approvals had been given to the following 11 users for the import of 12 systems between April 1, 1958 and February 28, 1979:

1. Messrs Informatics, Bombay
2. Mr S. K. Punwani, Bombay
3. Messrs Electronics Technology Co. Ltd, Bangalore
4. The Central Machine Tool Institute, Bangalore
5. Messrs Rading Cybernetics Pvt Ltd, Hyderabad
6. The Societe Internationale De Telecommunications Aeronautique, Bombay
7. Messrs Computer Maintenance Corporation, Bombay
8. Jaslok Hospital, Bombay
9. Radar Communications and Project Office, Ministry of Defence, New Delhi (2 systems)
10. Messrs M. A. S. Services Pvt Ltd, New Delhi
11. Systems Group, Department of Electronics, New Delhi

SEEPZ to Sell in the Home Market

The government is reported to have taken the decision to permit the sale of electronic products manufactured in the Santa Cruz Electronic Export Processing Zone (SEEPZ) in the country after payment of a special tax.

SEEPZ was established for the production of items for only export purposes, but circumstances have forced the government to institute a change in this regard.

Some foreign companies which had collaborated with Indian partners in SEEPZ have failed to honour their commitment in regard to exports. For instance, Century Electronics has been unable to sell its products because the foreign collaborator, Chronar Corporation Inc. has not honoured its commitment in regard to buying the products of the unit.

Products manufactured in SEEPZ cannot be brought under the existing framework of imports because indigenous labour and equipment are involved. To overcome this technical difficulty, the government has hit upon the idea of a special tax. Legislation for this purpose is likely to be introduced in the current Budget session.

ELCINA-IPAG to Hold a Seminar

Electronic Component Industries Association (ELCINA) and Information, Planning & Analysis Group (IPAG) of Electronics Commission will join hands to sponsor a seminar on electronic components in October this year at Bombay or New Delhi. The main objective of the seminar would be to devise ways and means for giving a boost to the components industry and to attract investments which have been shying away from this sector for a number of years because of lack of sufficient incentives.

NIC Computer Will Be Ready This Year

The National Information Centre (NIC) of the government of India is expected to be fully operational this year. It will have an experimental sub-network of 12 minicomputer terminals and a maxi-computer. The objective of the NIC computer network will be "to provide information to various ministries and assist them in taking decisions relating to economic and social development."

Mr N. Seshagiri, executive director of the NIC, has compared this computer network to electrical power grids and telephone systems. It will be of great use to decision-making bodies such as the Ministry of Finance and the Planning Commission.

First Video Tape Unit Inaugurated

The first video tape unit was inaugurated at Santa Cruz Electronic Export Promotion Zone (SEEPZ) near Bombay on March 11, 1979, by Mr L. K. Advani, the Central Minister for Information and Broadcasting. Mr Advani said that entertainment should have a social purpose and anything that might have a wrong or bad impact on the minds of the people, should be eschewed. He further said that this applied not only to film makers but also to the makers of video tapes.

Computer To Speed Up Indian Airlines Work

At present, the reservation system of Indian Airlines (IA) is so slow that the passengers are put to a lot of hardship. The central space control operating from Delhi for all sectors is not capable of handling reservations fast enough to cope with the rush at peak hours. However, the IA proposes to introduce the time computer system which, the experts say, is the only answer to the prayers of the officials of the corporation and the passengers. Its cost is estimated to be Rs 180 million.

Cooperation in Electronics

The agreements for cooperation in the field of electronics have been signed between our country and the European Economic Community (EEC), the USSR, Bulgaria, German Democratic Republic and Hungary. The agreements relate to trade and technical cooperation in electronic materials, components and equipment, and contain provisions regarding exploration of cooperative ventures in third countries. This information was given by the Prime Minister in the Lok Sabha in reply to a question on March 7, 1979.

And Abroad ...

'Telecommunications For All'

'Telecommunications for all' is the theme proposed for the 11th World Telecommunication Day which the 154 member countries of the International Telecommunication Union (ITU), the United Nations and the Specialised Agencies, a large number of non-governmental organisations and the news media are preparing to celebrate on May 17, 1979. Following an established custom, this event will take place on May 17, the anniversary of the founding of the ITU. The Union was founded in Paris on May 17, 1865—114 years ago—which makes it the oldest of the inter-governmental organisations of the United Nations system.

This year, World Telecommunications Day is of particular significance because events of historical importance in the development of the ITU are scheduled to take place in 1979. September of this year will see the opening of the World Administrative Radio Conference WARC-79 and the holding of the 3rd World Telecommunication Exhibition TELECOM 79 and the 3rd World Telecommunication Forum.

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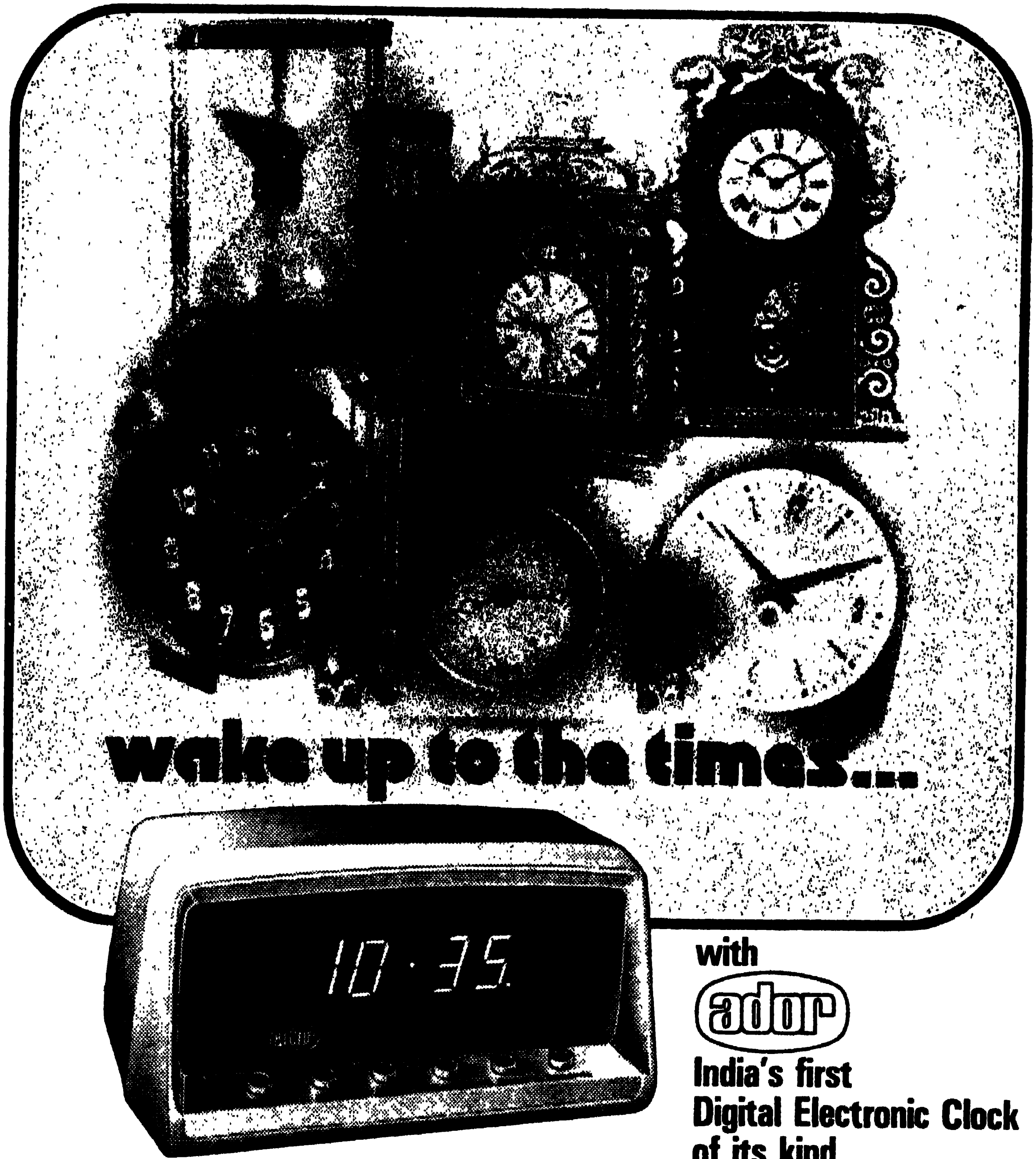

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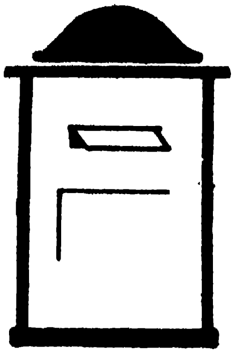
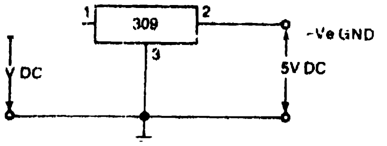


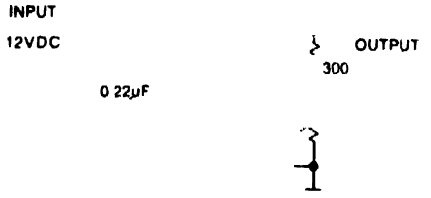
LETTERS

6V DC ADAPTER FOR RUNNING TAPE RECORDER IN CAR

Some time back you had published a circuit for an adapter giving a 6-Volt DC output, utilising among other components a 2N3055 transistor. I think, if we use a regulator like µA309 or LM309 the circuit will be cheaper. This is a 5-volt regulator with a current rating exceeding 1A. This is sufficient for most 6-volt appliances, and certainly for tape recorders. In fact, I am using it for a tape recorder in my car.



If 6-volt supply is required then the following circuit can be used after adjusting the preset for 6 volts:



These circuits are from the handbook of ICs in which the IC, µA309 was described.

PIYUSH CHANDRA
Bhopal

KITS & PRODUCT REPORTS

I am a regular reader of the EFY magazine. It is really what it claims to be—the most informative and provocative journal on electronics in India. However, I have a couple of suggestions to offer to enhance the utility of the magazine.

1. Nowadays a lot of consumer electronics products have begun to flood the Indian market. It would be very useful for prospective buyers if you could publish product reports after thoroughly evaluating the performances of these products. It would also be helpful if the price of the product, including excise duty, was mentioned for comparison.

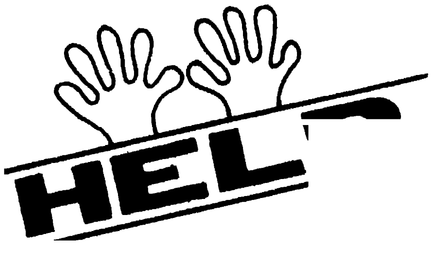
2. The hobbyists in India are at a disadvantage because kits for making various electronic projects are not readily available. If EFY can arrange to market electronic kits or publish the names of manufacturers who market these kits, it would be very helpful. For instance, if the cassette tape recorder circuit published in Annual Number 1979 is supplied in kit form, it will be a very interesting project for the amateurs and hobbyists to take up.

S. RAJA
Bangalore

RADIO LICENCE

Radio licence is an evil heritage of the British Raj which wanted to restrict our listening. There is no radio licence in Britain. Besides, the radio licence denies us the *right* to listen freely.

ASHWANI ARORA
New Delhi



PICK-UP TERMINAL

I have a transistor radio receiver ('Murphy', 9V operation) without any pick-up terminal for the operation of a record player. I want to know whether I can use the audio stage of the receiver for the reproduction of the record player output by directly connecting it to the volume control pot. (10 kilohm) through a switch. Will the reproduction be good? Or will the impedance matching be a problem, loading the record players?

If it is necessary to use an impedance matching circuit, please give me the details of this circuit.

S. Ramabhadram
9 (Upstairs), 13th Cross,
S. Pool Extn,
BANGALORE 560003.

MICROPHONE-CUM-SPEAKER

We are interested in procuring microphone-cum-speaker required in the production of hand-held communication equipment. Presently this item is being imported. Are there any indigenous manufacturers of this item?

Jayant R. Shah
TV Divn–Material Control,
Electronics Corpn of India Ltd,
Industrial Development Area, Cherlapalli,
Hyderabad 500762.

RECTIFIER

The rectifier, type CO NVO—5HQ—50 F, which is made in the form of a stick, is used in photocopier machine and seems to be of imported type.

I am unable to get the detailed specification of this rectifier and hence cannot find out the equivalent which may be used in its place.

Can anyone please help?

R. B. Kokane
Dy Director (Elec.)
Small Industries Service Institute,
Ministry of Industry,
Harsiddh Chambers, 4th Floor,
Ashram Road, Ahmedabad 380014

RADIO TUNER

Could you please let me know where I can get a radio tuner of the following specs:

Coverage: 0.5MHz to 30 MHz; AM mode
Selectivity: 8 kHz max.
Antenna: External
Power Supply: 220/250V AC, 50Hz; Consumption less than 10 watts
Output (AF): Mono/stereo wide frequency response suitable for 'tuner' input of domestic hi-fi mono/stereo amplifiers.
RF level indicator—meter or magic-eye—necessary.

The only respect in which my requirement differs from the models available readily is the coverage; I need up to 30 MHz while others have only up to 22 MHz (i.e. 13 mb.)

Sanjiv Sarma
9 University Campus,
Gauhati 781014.

If you are stuck up due to lack of some vital information, you may take the help of this column by writing to: *The Editor, Letters Section, Electronics For You, 303 Dohil Chambers, 46 Nehru Place, New Delhi 110019.* Those of the readers who can help are requested to write directly to the person in need of the information.

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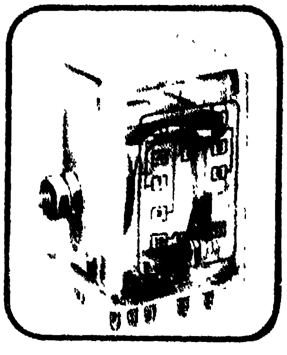
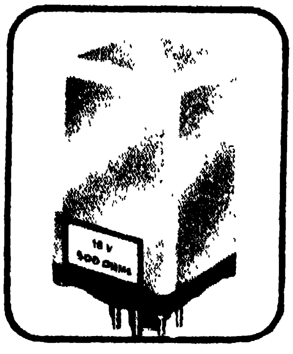
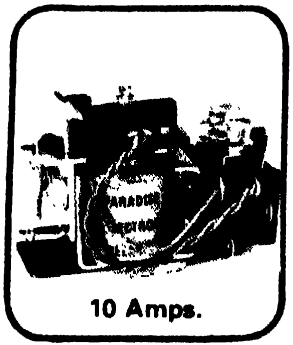
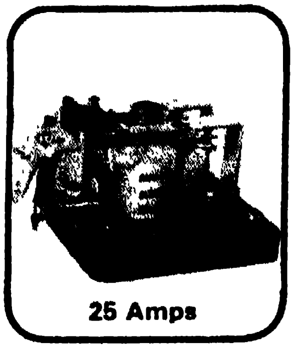






10 Amps.



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DO YOU HAVE A 'DIGITAL SCREWDRIVER' IN YOUR TOOL BOX?

Bruce Hanson

The digital integrated circuit (IC) has revolutionised many industries. Through the digital IC, all phases of a heretofore analog world are exploding with more complex, compact, and powerful products than ever before. But this advance in electronics has not come without a price. The digital integrated circuit has also brought a major headache in maintaining and repairing these products. Fundamental differences between analog and digital circuits, and the resulting needs for new instrumentation and troubleshooting techniques are responsible for these problems.

Although more reliable than earlier electronic circuits, the IC has greatly increased circuit density and complexity. As a result, an entire new class of troubleshooting instruments has evolved to service IC-based equipment, just as oscilloscopes, digital voltmeters, and signal generators were developed to service older analog equipment. While many of us may have grown up using scopes and DVMs, and are intimately familiar with them, there are digital troubleshooting tools that are easier to use around ICs and will help us to be more effective.

What is a logic probe?

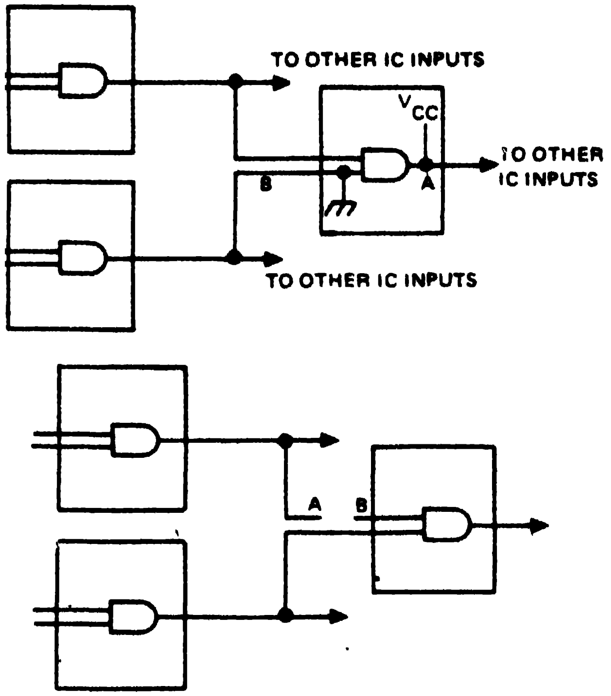
One of the most common test tools for digital circuits today is the simple, hand-held logic probe. In fact, in the last several years it is estimated that over 100,000 probes have found their way into everyday use as the 'digital screwdriver' of today's electronic revolution.

The probe doesn't solve all digital troubleshooting problems: there are several other types of products available that round out the digital troubleshooter's tool bag. But what probes do offer is cost-effective value wherever they are used. They provide simple readouts that quickly tell the user if a circuit appears to be functioning, and many times that's all the information needed. They also let the user know very quickly whether additional troubleshooting tools need to be used.

Probes indicate logic conditions by employing a lamp. In general, a lit lamp indicates a logic '1' or logic 'high'. Other manufacturers employ coloured LEDs in various patterns to show logic states, but all have the same goal: to simply and quickly show if a circuit is 'high', 'low', pulsing or has an open circuit.

What can a probe do?

Probes quickly show if a circuit is operating at all. For example, a control line might be expected to go to a logic 'high' to open a valve under the right conditions. A probe can easily show whether that line ever goes 'high,' or perhaps if it goes 'high' and then stays there.



These two drawings illustrate common problems that can be detected with a logic probe. In the upper drawing there is a short between Vcc or ground. All signal lines connected to point A are held in a high state, and in a low state at point B. The lower drawing illustrates an open circuit. All inputs attached to node at point A will be driven properly; those at point B will float to a "bad level."

Probes with a memory function can also be left connected to a line to look for infrequent pulses, or even for sporadic noise conditions ('glitches') that act like unwanted pulses.

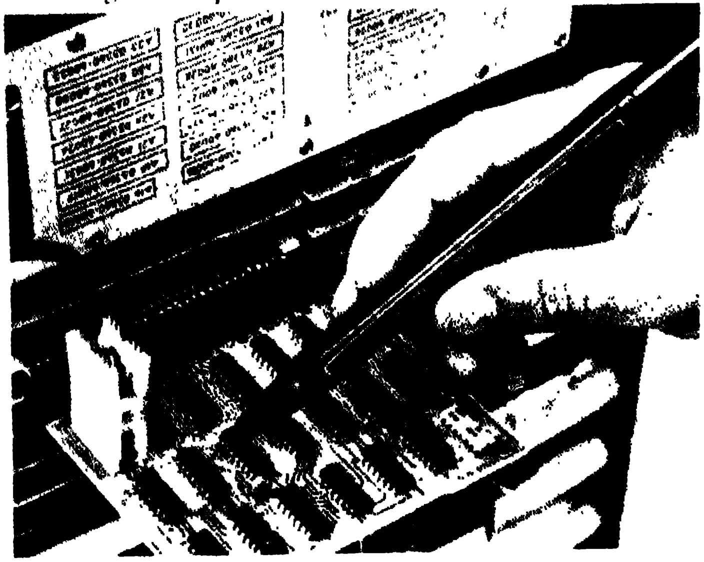
At any rate, the probe acts very much like a '1' or '0' meter that is energised by the power supply of the circuit under test to provide direct, simple, inexpensive answers on-site.

How is the probe used?

Designed for general troubleshooting use in digital circuits, probes are used by field service, R&D, and production personnel.

Probe use is simplicity itself: just connect power to it from the circuit under test and start probing. In a TTL circuit, for instance, all the ICs have a 5V DC supply. Just connect the plus (+) and minus (−) leads to the power pins of any IC (generally either pins 7 and 14, or 5 and 10), and the probe's lamp glows at half brilliance. Then, probe any pin anywhere in the circuit. The probe will indicate as follows:

State	*Indication*
'High'	Lamp on full
'Low'	Lamp off
Pulse trains	Lamp flashes at approx. 10Hz
Open circuit	Lamp at high-brilliance
Occasional pulses	
(a) Steady 'low' then single 'high' pulse	Light flashes on momentarily
(b) Steady 'high' then single 'low' pulse.	Light turns off momentarily



A logic probe can often quickly find and isolate a digital problem from the board level to the device level, if so required. The probe is a basic "tool" for digital troubleshooting.

Other troubleshooters

Probes provide a lot of power for digital troubleshooting because of their ease of use, portability, and price. And they can be supplemented by other inexpensive hand-held products to allow stimulus-response testing in digital circuits.

Here are digital test devices that can be used singly or together. They are all simple to use.

Logic probe : The logic probe is a digital state(highs and lows) indicator which provides an indication of a high level, low level, or bad level signal. Internal threshold detectors determine if the signal being probed is above the high threshold level, below the low threshold level, or in between these two. The probe provides:

1. Stretching display for short pulses
2. Pulse memory
3. 10ns pulse response
4. Multi-logic family
5. 'Bad level' detection

Logic pulser: In an easy-to-use probe package, the logic pulser injects into the circuit a single pulse of proper amplitude and polarity each time its button is pushed. If the node was 'low' it will be pulsed 'high', and if it was 'high' it will be pulsed 'low'. The pulser's capabilities thus include:

1. Ability to drive 'low' nodes 'high', or 'high' nodes 'low.'
2. High current output, but low duty cycle to protect ICs from damage.

Logic clip: The logic clip is another digital state indicator. It allows up to 16 signals on a single IC to be observed simultaneously. The clip has a single threshold level. If a signal on a given IC pin is above this level, an LED in the clip is turned on corresponding to that pin. If the signal is below this level, the LED is turned off. The clip features:

1. 14- or 16-pin readout
2. Multiple logic family operation

Many times a circuit is powered up, but during troubleshooting some method is needed to stimulate it. For this reason, a logic pulser (signal) is helpful. It provides stimulus for stimulus-response testing. For example, the user wants to know whether an inverter gate is functioning, so he pulses the input and observes the output with a logic probe.

When the input is momentarily pulsed 'low,' a temporary 'high' condition should exist at the output. Since pulsers typically put out very short high energy pulses, they can force the inverter to momentarily change logic states. The probe, on the other hand, possesses a 'stretching' circuit that automatically detects short pulses and provides a visible display of pulse occurrence. This type of testing is very similar to analog stimulus-response testing. For example, a radio receiver can be tested using a signal generator at its input and an AC voltmeter at its output to achieve the same result in the analog domain.

Analog tools are valuable in digital troubleshooting, but generally only after digital tools like probes and pulsers have indicated that reading functional 'ones' and 'zeros' is insufficient to solve the problem in a circuit.

Where do they fit?

For purposes of general classification, hand-held digital troubleshooters can be called 'node and gate' troubleshooting tools. Used stand-alone or in various combinations, they can isolate bad nodes (a node is any signal line linking one or more ICs), and gates (a gate is any single IC circuit such as an inverter, AND gate, flip-flop, etc).

There are several levels of troubleshooting to consider. These include:

1. System Level Troubleshooting—instrument swapping; isolate problem to one part of the system; use soft-

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ware etc to narrow down problem.

2. Instrument Level—circuit board swapping; isolate problem to one circuit board in an instrument.

3. Board Level—bad node isolation; isolate problem to a circuit (node) by using schematic, logic analysers, logic comparators, and/or logic probes to identify bad nodes.

4. Node and Gate Level—use stimulus-response testing, employing probe, pulser, current tracer and/or clip to identify the one bad integrated circuit (microprocessor, ROM, AND gate etc) on a circuit board.

Simple digital troubleshooting

When troubleshooting circuits are built from analog components, the task is one of verifying relatively simple characteristics such as resistance capacitance, or turn-on voltages of components with two or, at most, three nodes. While the function of the total circuit may be quite complex, each component in that circuit performs a relatively simple task and proper operation is easily verified. Each diode, resistor, capacitor and transistor can be tested using a signal generator and a voltmeter, ohmmeter, diode checker, or oscilloscope—the traditional troubleshooting tools. But when this circuit is built in integrated circuit form, these components are no longer accessible. It now becomes necessary to test the operation of the complete circuit function.

The first step in any troubleshooting process is to narrow the malfunctioning area as much as possible by examining the observable characteristics of the failure. This is often called 'front panel milking' From the front panel operation (or rather mis-operation) the failure should be localised to as few circuits as possible. At this point it is necessary to narrow further the failure to one suspected circuit by looking for improper key signals between circuits. The logic probe can be very effective here.

In many cases, a signal will disappear completely. By rapidly probing the interconnecting signal path, a missing signal can be readily detected. Another important failure is the occurrence of a signal on a line that should not have had a signal.

Dependence upon a well-written service manual is the key to this phase of troubleshooting. Isolating a failure to a single circuit requires knowledge of the instrument or system and its operating characteristics. A well-written manual will indicate key signals to be observed. The logic probe then provides a rapid means of observing the presence of these signals.

The logic probe can be used to observe the signal activity on inputs and to view the resulting output signals. From this information, a decision can be made as to the proper operation of the IC. For example, if a clock signal is occurring on a decade counter and the enabling inputs (usually reset lines) are in the enabled state, then the output should be counting. The logic probe will allow the clock and enabling inputs to be observed. If pulse activity is indicated on the outputs, then the IC can be assumed to be operating properly. Usually it is not necessary to see the actual timing of the output signals since ICs fail catastrophically. The occurrence of pulse activity is often enough indication of proper operation.

The logic pulser shown on the right side of photo is a good companion to a logic probe because it can provide pulses for added testing capabilities.

This first step might be called the 'mapping' step since the effect is to map out the problem areas for further investigation. It is important to do a complete 'mapping' of the circuit before proceeding to analyse each of the indicated failures. Prematurely studying a fault can result in overlooking of faults which cause multiple failures, such as shorts between two nodes.

A test for a short to Vcc or ground can be done easily using a logic pulser and probe. The pulser injects a pulse while the probe on the same node observes the pulse. No pulse indicates a short to Vcc or ground. The occurrence of a pulse indicates that the node is not shorted, and the absence of a pulse indicates the node is shorted to Vcc (if it is a high) or ground (if it is a low).

The logic probe provides a rapid means of not only detecting, but physically locating 'opens'. Since an open signal path allows the input to the 'right' of the open to float to a bad level, the logic probe can be used to test the input of each IC for a bad level. Once an input floating at a bad level is detected, the logic probe can be used to follow the circuit back from the input looking for the open. This can be done because the circuit to the 'left' of the open will be a good logic level (either high, low, or pulsing) while the circuit to the right will be a bad level. Thus, probing back along the signal path will indicate a bad level until the open is passed. This means the probe can be used to precisely locate the open. The open can then be repaired and the circuit tested. ☐

AUTOMATIC POLARITY CHANGEOVER FOR MULTIMETERS

J. R. Byju

Wherever a number of DC voltages have to be measured with a multimeter in a circuit, one has to either frequently interchange the probes or operate a switch to take a proper reading on the meter. This nuisance can be removed easily. The easier of the methods is, however, not very satisfactory.

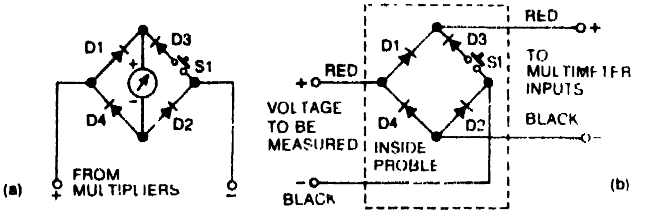


Fig. 1: A simple method of automatic polarity changeover.

A simple method

The easiest way to overcome this problem is by inserting a bridge rectifier either within the meter or at the input to the multimeter. The rectifier will take care of the polarity in either case, as shown in Figs 1(a) and 1(b). Both these circuits perform the same functions. The push-to-open switch fitted to one arm of the bridge gives an indication of the polarity.

The circuit shown in Fig. 1(a) can be wired inside the multimeter itself while the circuit shown in Fig. 1(b) may be wired in a special DC probe housed in the body of a miniature pen torchlight. When a voltage is applied, the meter's pointer deflects in the proper direction, irrespective of the input polarity.

Germanium point contact diodes with a low forward drop and low leakage should be used in the circuit shown in Fig. 1(a) while silicon diodes of high PIV rating should be used in the case of circuit shown in Fig. 1(b). In both cases, all the diodes must be matching.

On pressing the push-button switch S1, if the meter continues to read it indicates that the current is flowing through D1 and D2 and that the voltage is of positive polarity. If the meter reads zero when S1 is pressed, it indicates that the current was flowing through D3 and D4 and was interrupted by the opening of S1. This means that the polarity of the input voltage is negative.

Both these circuits, however, suffer from a serious drawback. They affect the meter's calibration and also the linearity of its scale because of the non-linear characteristics of the diode. This effect is more pronounced in the low-voltage range, where the input voltage is near the forward conduction voltage of the diode. The readings, therefore, can no more be accurate.

Another disadvantage of these circuits is that a switch has to be pressed to know the polarity.

The circuit shown in Fig. 1(a) affects all the ranges in the same fashion because it is connected after the multipliers. Therefore, the meter can be recalibrated for correct readings. The scale cannot be made linear, however.

The circuit of Fig. 1(b) behaves in a different way. Here the bridge is wired inside a special DC probe. The diodes used must have a voltage rating equal to that of the maximum voltage to be measured. Here the effect of the bridge will be notable only in the low-voltage ranges. In the higher voltage ranges the diode drop is negligible when compared to the measured voltage. So this configuration can be used in a multimeter without altering the calibration in the higher ranges. Of course, the accuracy and linearity of the scale will deteriorate in the lower ranges.

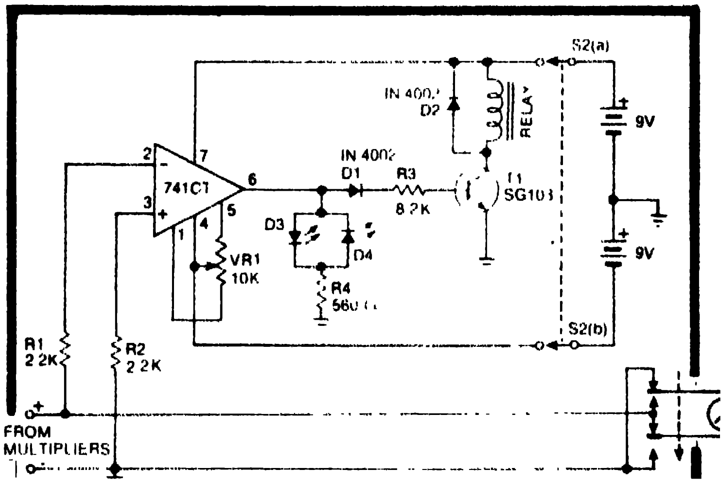


Fig. 2: The automatic polarity changeover with indicator.

The automatic polarity changeover circuit

A circuit which in no way affects the calibration or linearity of the meter is shown in Fig. 2. Another advantage of this circuit over the previous two circuits is that it can be switched off when not required and the multimeter can be used as usual. Moreover, it consumes very little power when the relay is not energised.

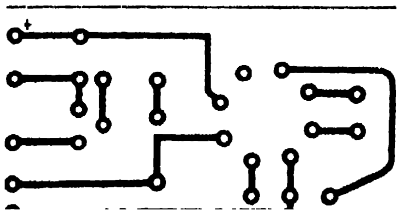
The circuit senses the polarity of the voltage to be measured and operates a relay in such a way that the voltage fed to the moving coil unit is of the correct polarity. The unit also gives an indication of the polarity.

The circuit

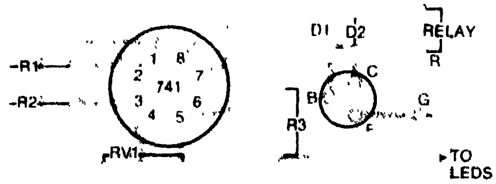
The input stage of the circuit shown in Fig. 2 consists of an operational amplifier (CA 741 CT) in the open loop mode, which works as a switch. It senses the polarity of the voltage to be measured and gives an output corresponding to the polarity.

The connections to the moving coil unit of the multimeter are made through the relay The same meter inputs are connected to the IC. The inverting input (pin no. 2) is connected through R1 to the line going to the positive terminal of the meter. The non-inverting input (pin no. 3) is grounded through R2. The negative line going to the meter is also grounded.

Transistor T1 energises the relay when the opamp output is positive. Diode D2 bypasses the high surge voltages developed across the relay coil and prevents them from damaging the transistor. Diode D1 allows only positive voltage to pass to the base of T1, and it also provides a higher threshold of switching. D3 and D4 are LEDs which give an indication of the polarity. R4 limits the current passing through the LEDs. The split rail power supply for the opamp is obtained by using two 9 V energiser batteries.



(a) ETCHING PATTERN (COPPER SIDE) ACTUAL SIZE



(b) LAYOUT

Fig. 3: Printed circuit pattern (a) and components layout (b).

Working

When the voltage being measured is of positive polarity, the plus rail to the moving coil unit will be positive and the minus rail will be negative. This makes the inverting input of the opamp positive with respect to the non-inverting input. The opamp output now switches to -9V and T1 remains cut off. The connections to the moving coil unit are now made through the N/C contacts of the relay and the meter reads as usual. Since the output of the opamp is -9V, LED D4 (red) lights up, indicating a positive voltage.

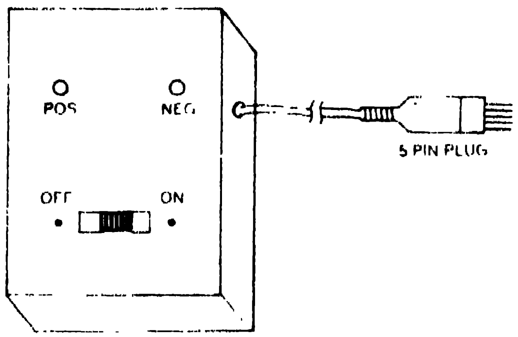


Fig. 4: Cabinet mounting.

Now if the voltage being measured is negative, the inverting input of the opamp is negative with respect to the non-inverting input and the opamp output swings to + 9V switching on transistor T1. The relay is now energised and the connections to the moving coil are reversed (i.e. through the N/O contacts). Since the output of the opamp is now + 9V, LED D3 (green) lights up, indicating a negative voltage.

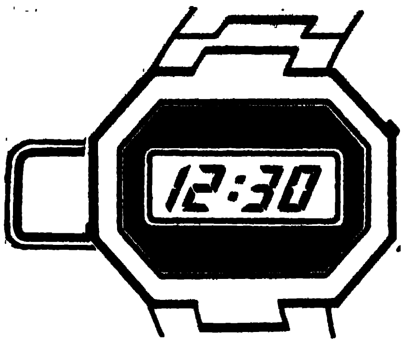
Since only the relay contacts are included in the meter's circuit, the calibration or linearity of the meter is not at all affected. The input impedance of the opamp is very high (between 1 megohm and 10 megohm). Therefore, this also does not affect the meter's calibration.

Construction

The whole unit can be mounted in a plastic box. The PCB pattern and layout is shown in Fig. 3. The relay, battery and the wired PCB is placed inside the box. The LEDs can be fixed to the box with 'Araldite' or 'Quickfix.' The connections to the multimeter can be made directly or with a 5-pin DIN socket and plug, as shown in Fig. 4.

Adjustments

After the circuit is wired, it should be checked thoroughly for proper connections and polarities (preferably by someone else). Offset adjustment of the opamp can then be made by grounding pin nos 2 and 3, and adjusting VR1 for zero voltage at pin no. 6. The circuit is now ready for use. ☐



Special Supplement : ELECTRONIC CLOCKS & WATCHES

WATCH THE NEW WATCHES

All over the world, the mechanical watch is giving place to the electronic watch. According to a rough estimate, one-third of the watches in use at present are electronic. It seems that the electronic watch has caught the imagination of the people and it is fast displacing the mechanical watch. Although in our country the manufacturers have not been able to fully satisfy the demand for even the mechanical watches, the demand for electronic watch is catching on. Because of its high price in this country, it is yet considered more of a status symbol than a useful consumer durable.

The policy of the government of India has been not to encourage the manufacture of electronic watches in this country. Two reasons have been advanced in support of this policy. First, all the vital components needed for an electronic watch have to be imported from abroad. We do not have indigenous sources of supply for them. Second, it is not considered to be a vitally needed item of mass consumption; hence the government has no plans to issue any new licences for the manufacture of electronic watches. At present, the major producers of electronic watches in the country are seven in number. Their names and addresses are given elsewhere in this supplement.

Some small units are also manufacturing electronic watches by making use of imported components — components which are imported not through lawful means. But the total number of electronic watches manufactured in the country is still very small. In fact, no data relating to the production of electronic watches has been issued by the government so far.

The sub-group on consumer electronics appointed by the Planning Commission Working Group on Electronics Industry last year under the chairmanship of Dr Amarjit Singh (CEERI, Pilani) has forecast the demand for these watches in the five years ending in 1982-83. According to the group, the value of electronic watches likely to be produced in 1979-80 will be around Rs 30 million, which will multiply 10 times to rise to the value of Rs 300 million in 1982-83. In the five years under reference, the total demand for electronic watches is estimated to be around Rs 570 million. However, in the first year of the Seventh Plan period, i.e. 1983-84, the value of production of these watches is estimated to be around Rs 450 million.

It is not known what price of a watch has been assumed in these computations. At present, the price of an electronic watch is about Rs 500 in our country, while in Hong Kong, Taiwan and Singapore it is less than Rs 100. On the basis of the prices prevailing in our country, the total number of electronic watches likely to be produced in the five-year period ending in 1982-83 is a little more than a million, which will be a very small fraction of the total demand for watches in our country.

A survey conducted by Hindustan Machine Tools Ltd in 1972 indicated that the total annual demand for mechanical watches in the country was 4.5 million. By 1977, it was estimated to have risen to about six million. Recently, the Minister of State for Industry, Mr J.P. Yadav, told Parliament that the current annual demand for watches (all types) was placed at 6.5 million which was expected to rise to 8.5 million by 1981-82. The government had given licenses for the manufacture of about six million watches a year, but the production of watches in 1978 was 4.7 million. It is obvious that the gap between the indigenous supply and demand of mechanical watches is being fast bridged and the smuggling in of these watches is on the decline. This however cannot be said about electronic watches.

The moot question is: Why should we not set up indigenous capacity in electronic watches so as to cut out smuggling and the outflow of valuable foreign exchange resources? The time has come when the government should change its out-moded outlook. For years it failed to realise the need for creating capacity for mechanical watches. The result was that smuggling in of watches cost the country a heavy dose of foreign exchange. Now the same story should not be repeated in the case of electronic watches.

The Swiss makers of mechanical watches are now watching anxiously the fast developments in the field of electronic watches. Taiwan, Hong Kong, Singapore and Japan are the leaders in this field, though the source of R&D is the USA. An astonishing thing which is happening is the rapid growth of R&D in this sophisticated field which has one and only effect: to reduce the price of electronic watches.

Let it be noted that the electronic watch like any other consumer durable such as radio set, television set, fan etc is price-elastic. The size of its market grows with every drop in price. And the fall in the price of electronic watch during the past five years has been precipitous.

What about the Indian market? Most of the so-called makers of Indian mechanical watches are in fact assemblers of watches which are imported either in semi-knocked down (SKD) or completely knocked-down (CKD) condition. And their prices will soon exceed those of electronic watches. So, whether the government of India likes it or not, the electronic watch is going to take the place of mechanical watch.

How long will it take the electronic watch to replace the mechanical watch in our country? This is a question which cannot be answered today with precision because much depends upon the foreign exchange position of the government in the coming years. However, once the price of the imported electronic watch rules lower than the price of the mechanical watch in the world markets, the pressure for switchover will mount.

The government of our country is an interested party. Its undertaking — Hindustan Machine Tools (HMT) — which currently manufactures and markets the largest number of mechanical watches will be the first to be hit by the onslaught of the electronic watch. The government may slow down the import of electronic watches in order to save HMT from losses, and what is more, increasing unemployment of workers. But the time will come when HMT and the government will have to change their outlook.

Keeping in view the thinking of the government of the centre, it will easily take a decade for the electronic watch to acquire supremacy. By the end of 1989, we predict, the electronic watch in this country will rule supreme. This is the shape of things to come —as ELECTRONICS FOR YOU sees it.

It is now established that the market for liquid crystal display (LCD) watches which give a continuous display of time will grow much faster than that for light-emitting diode (LED) display types which give only an intermittent display of time.

The 3.5-digit five-function watch is quoted in Hong Kong at less than US $ 10 (Rs 85) each. The profit margin in such watches is dwindling fast and the manufacturers are taking to six-digit designs with upgraded features so as to be able to raise prices and have a higher profit.

The new watch which is gaining popularly is one which combines the watch and the calculator. Ricoh, Seiko and other companies from Japan, Hong Kong, Taiwan and Singapore are all trying to grab a share of the market for such a multifunction watch. Some manufacturers have also added the alarm function to such a watch.

Despite the addition of new functions, the prices have been moving downward due to keen competition. The manufacturer who enters the market with a new design and a new combination of functions, is able to earn a good profit in the first round. As soon as the competitors enter the market with watches having almost similar functions, the prices crash. According to knowledgeable circles, the rock bottom in watch prices — as in the case of electronic calculators — has still to be reached.

Another feature of the electronic watch which is being popularised is its thinness. Thin looking watches are now making their appearance in the markets of the world. And the functions include hours, minutes, seconds, month, date, day of the week and an automatic calendar. The truth is that the last word has yet to be said about the electronic watch, what with the new innovations being tried every day. □

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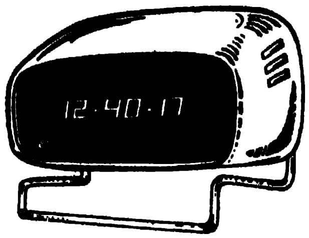

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Need for Increase in Licensed Capacities for Electronic Watches

Interview: S.L. Mirchandani

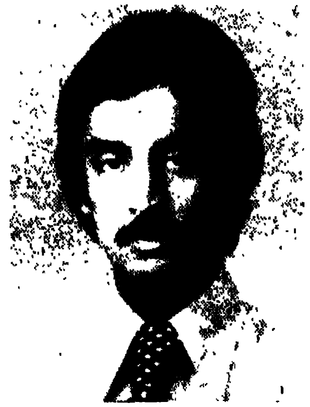
Mr S.L. Mirchandani, managing director of Monica Electronics Pvt Ltd, New Delhi, was interviewed by EFY's managing editor to find out his viewpoint on the status of electronic watches industry in India. Though young in years, Mr Mirchandani began marketing of 'Onida' watches about 1½ years ago. A B.Com. himself, he joined hands with his elder brother, who possesses a degree from CEERI, Pilani, to start the 'manufacture' of digital electronic watches without any foreign collaboration. Learning from experience, he is now assembling and testing the watch modules within his factory, instead of importing the pre-assembled and pre-tested modules.

Q: What is the indigenous content in the digital electronic watches being assembled in India.

A: At present, virtually the entire kit of components required fof their manufacture is being imported.

Q: Including the casing and strap?

A: Stainless steel casing of quality is not yet made in India, though we are planning to set up a unit for this purpose shortly in Bombay. Some people are making casings in brass, but these are not of a very good quality. The straps for watches are, of course, available freely in India, but these are not included in the imported 'kit' of electronic components for the watches.



Q: Besides the casings for watches, aren't there any other items which can be taken up for production in India?

A: By the end of 1979 or early next year, I think at least 40 per cent of the components, by value, would have been taken up for production — provided the units like Keltron and BEL keep up their promises.

Q: What do you expect them to contribute for the indigenisation of the watch industry?

A: Keltron has promised to provide us with the quartz crystals while Bharat Electronics (BEL) is expected to deliver us the LCD displays for digital electronic watches.

Q: What if they start manufacturing electronic digital watches themselves? After all, Keltron did apply for a letter of intent — though its application was rejected.

A: I think such public sector undertakings should concentrate on the manufacture of the basic components only — they should not go in for assembly jobs which can very well be left to the small-scale units.

Q: How many units have been licensed to make electronic watches in India?

A: As far as I know, there are only four. But the licensed capacity for the production of each of the units is very very small. This limitation has restricted our growth.

Q: How is the profitability of your venture?

A: Due to limited production we are unable to make any profit. Our margin for each assembled watch is of the order of Rs 25 only, and even this much profit on a watch is denied to us if it comes back for repair during the guarantee period.

We are sticking to this line in the hope that we shall be allowed to assemble at least 10,000 watches a month in the near future.

Q: Do you think the demand exists for so many electronic watches in India?

A: The demand is dependent on price. If we can increase the volume of production, we can also lower the prices — because the overheads remain more or less the same whether I assemble 20 watches a day or 400 watches a day.

Prices of electronic watches are high at present also due to the very high rates of duties levied on its various components. About 60 per cent of the price one has to pay for a watch goes for the taxes.

If these taxes could be reduced and licensed capacities of the units making electronic watches increased then perhaps their prices could be brought at par with the international prices. □

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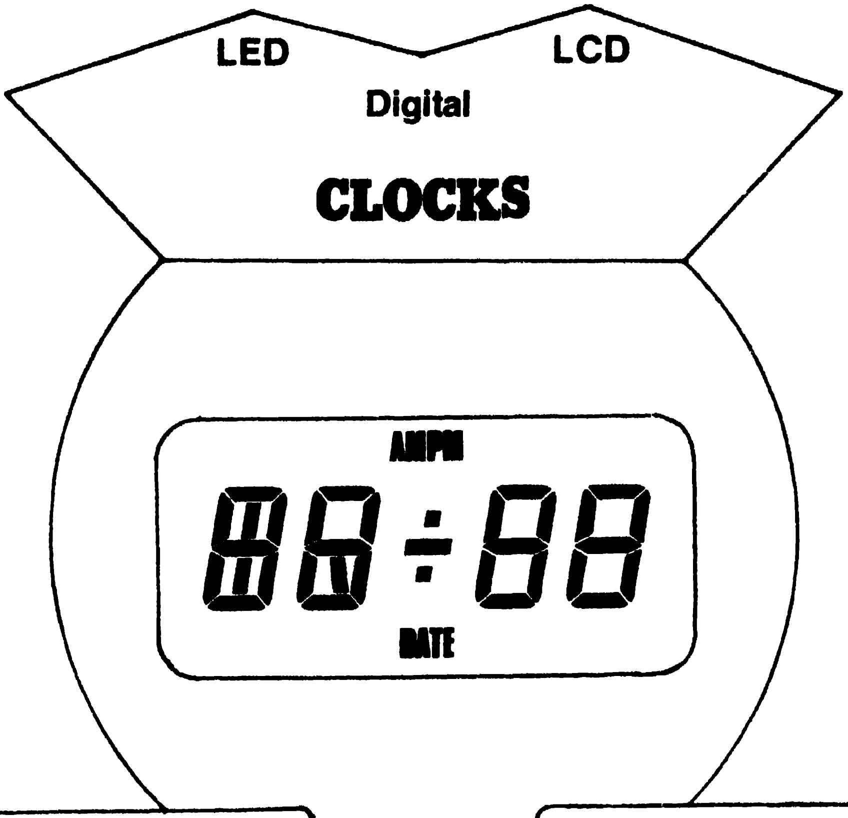

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CONSTRUCTION

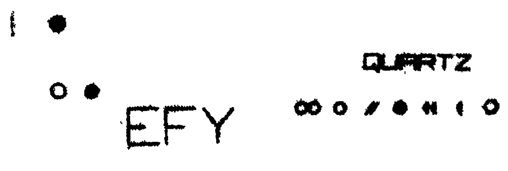
Make Yourself This Crystal-Controlled ELECTRONIC DIGITAL CLOCK

M.S. Dhingra

This project describes the construction of a quartz-crystal-controlled electronic digital clock with an alarm facility. The clock is unique in design in the sense it can be assembled using various discrete devices, and is not based on a single module. This enables the replacement of only faulty component instead of discarding the entire module, should anything go wrong. The clock chip used in the circuit offers a number of special features such as seconds display, snooze and sleep timer, blinking colon, a.m. and p.m. indications, and battery back-up, besides alarm. All the items used in the clock are freely available in metropolitan cities.

Circuit description

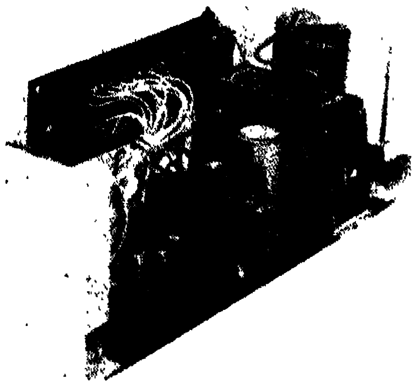
The complete circuit diagram is shown in Fig. 1. Heart of the system is IC2, National's MM5402 clock chip. It is an MOS monolithic large scale integrated circuit. Its pin configuration is shown in Fig. 2. The supply is derived from the mains through a low-voltage stepdown transformer X1. As shown in the diagram, 9-volt DC supply derived by diode D3 and capacitor C1 is fed to the counting circuit of the clock chip at pin 29 through a 1k resistor. A bypass capacitor C5 is used at input of clock chip for protection from high-frequency transients. The current requirement for the entire clock chip is around 4.5 mA.



Author's Prototype of the assembled clock

The clock input pin 35 is fed by 60Hz clocked pulses. These are derived by 3.579 MHz quartz crystal oscillator formed with IC1, National's MM5369 chip, which is also a frequency divider. Its output at pin 1 is 60Hz square wave. For trimming the crystal frequency, a trimmer (C4) is also provided which could be used for improving the accuracy of time.

For display, Fairchild's FND500 seven-segment light emitting diodes (LEDs), D7 to D10, are used. These are common-cathode LEDs. Since the clock chip's segment output is of the order of 10 mA, no interfacing is required. The various LED segments are only to be connected to the respective clock outputs. In all, four LED displays are required, and these can be straightaway soldered on to a separate PCB or breadboard. Supply to the display LED is obtained from the 3V tap of transformer X1.



Inside view of the clock as seen from back.

The pin configuration of FND500 is shown in Fig. 3. The blinking colon is also available in the FND500 display. It is provided at pin 5 of the display, and may be connected through a 220-ohm current limiting resistor to pin 39 of the clock chip. The a.m. and p.m. displays are obtained by using two LED lamps, D5 and D6, and connected to pins 1 and 40 of clock chip through 220-ohm current limiting resistances.

All the display functions are obtained by simply connecting push-button switches at various control inputs, and grounding the respective input. In the prototype a self-assembled seven-reed assembly of switches was used. However, though costlier, the miniature calculator keyboard switches made by O/E/N India Ltd are the best for this purpose.

Alarm output is available at pin 25 of the clock chip. Since this output is quite low, a current driver is used. This driver is formed by the transistor T1 and a few supporting

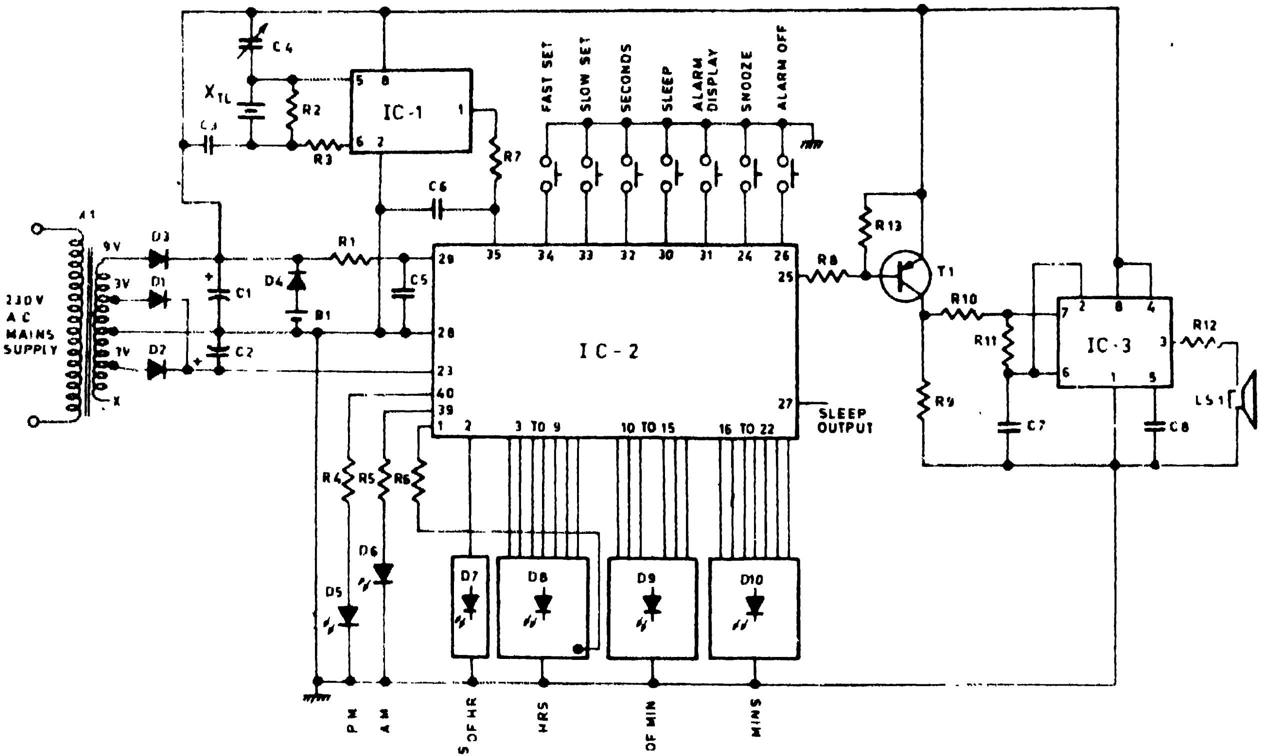


Fig. 1: Complete circuit diagram of digital clock

PARTS LIST

B1—9V battery, Eveready' type 216 or 266
C1—1000μF/15V DC electrolytic capacitor
C2—470μF/10V DC electrolytic capacitor
C3—30pF silver mica capacitor
C4—22pF trimming capacitor
C5, C6, C8—0.01μF/50V paper capacitor
C7—0.02μF/50V paper capacitor
D1 to D4—1N4001 diode
D5, D6—LED lamp
D7 to D10—Seven-segment, common cathode LED display, 'Fairchild' type FND 500
IC1—'National' IC, type MM5369
IC2—'National' IC, type MM5402
IC3—Timer IC, type 555
LS1—Loudspeaker, 6.3cm dia, 8-ohm/0.5W
R1, R3—1-kilohm resistor
R2—20-megohm resistor
R4 to R6—220 ohm resistor
R7, R10—100-kilohm resistor
R8, R13—4.7-kilohm resistor
R9—22-kilohm resistor
R11—10-kilohm resistor
R12—150 ohm resistor
(All resistors carbon type, ½W rated)
X1—230V to 3/6/9V, 700mA, centre-tapped transformer
T1—'BEL' BC177 transistor
XTL—3.579MHz quartz crystal

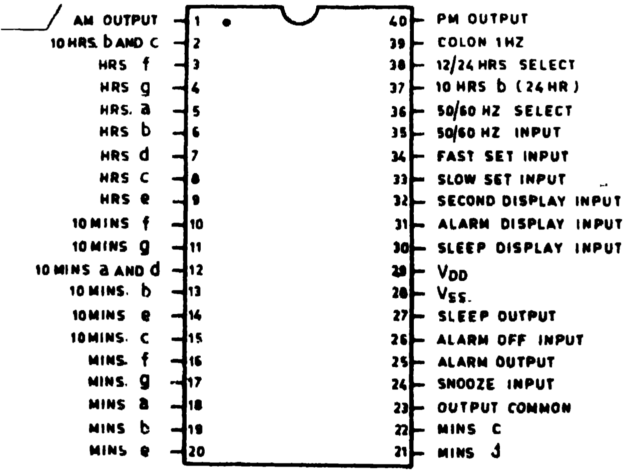


Fig. 2: Connection diagram of IC MM5402 (top view)

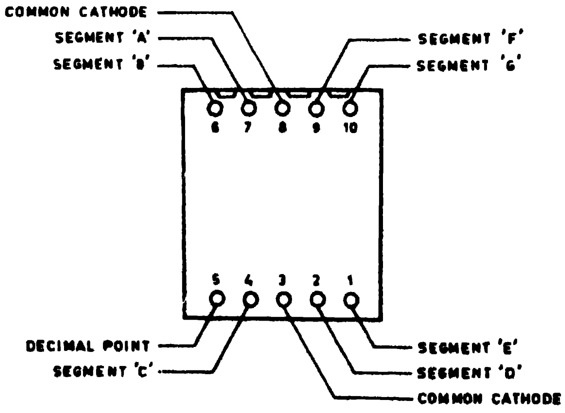


Fig. 3: Pin connections of the FND500 display.

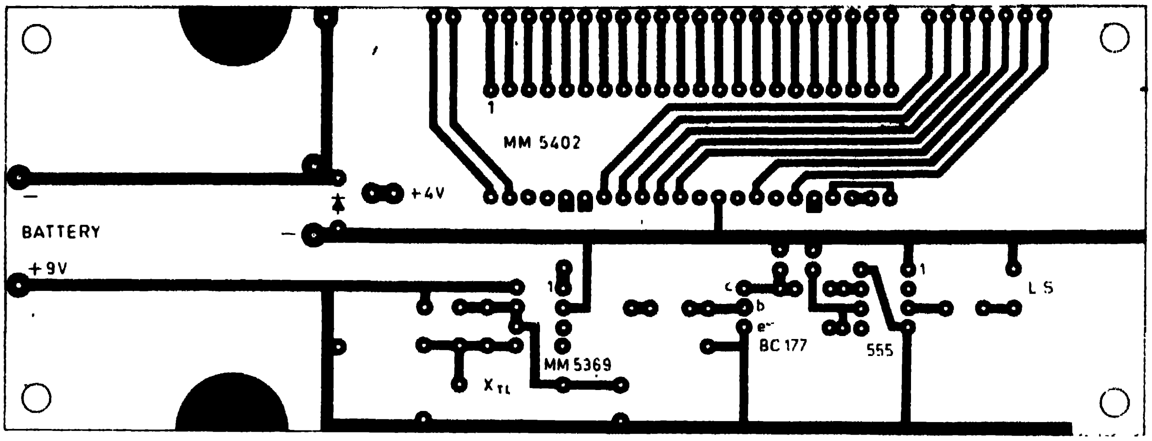


Fig. 4: Actual-size PCB pattern and drilling guide.

Control functions

In all seven controls are provided. They may be coded, as in the prototype. Their functions are:

oo —Fast set. On pressing this button, the clock display advances at the rate of 60 Hz. It is meant for initial setting of time.

o —Slow set. The clock advances at the rate of 2 Hz on pressing this button. It is meant for a finer adjustment of clock time.

// —Seconds display. On pressing this button, the clock displays time in seconds. The time is displayed once again in hours and minutes when this button is released.

● —Sleep display. On pressing this button, sleep time is displayed which can at the most be 59 minutes.

◀◀ —Snooze. This button is for repeating the alarm every nine minutes to enable the person to wake up on a subsequent alarm if he misses the first.

◀ —Alarm set. On pressing this button the clock displays the alarm setting. When this button is pressed, the clock shows 12.00 hrs. However, on keeping it pressed and simultaneously pressing the fast set button, the alarm is set for the desired time.

◇—Alarm off. This button is meant for switching the alarm off.

Additional displays can be derived by controlling inputs as tabulated.

Selected display mode	*Control input*	*Control function*
Alarm	1. Both (slow and fast)	Alarm sets to 12.00 a.m.
	2. Slow	Alarm minutes advance at 2 Hz.
	3. Fast	Alarm minutes advance at 60 Hz.
Seconds	1. Slow	Input to entire time counter is inhibited.
	2. Fast	Seconds and tens of seconds reset to zero without carry to minutes.
	3. Both	Time resets to 12.00 a.m.
Sleep	1. Both (slow and fast)	Subtracts counts at 60 Hz.
	2. Slow	Subtracts counts at 2 Hz.

components, as shown. For a gentle alarm sound, tone is generated by IC3, which is an Indian timer IC, 555. The tone can be varied by changing the value of capacitor C7. An 8-ohm, 0.5-watt speaker of 6.3cm dia should produce sufficient sound to be heard across the room.

The sleep output at pin 27 of the clock chip is similarly amplified and used to drive a relay which can control any audio or electrical equipment. The function of sleep timer is to switch off a radio set, tape recorder, TV etc after a preset time, within the maximum duration of 59 minutes.

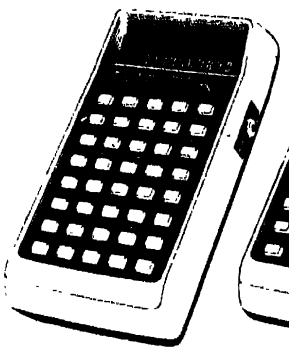
Since the clock chip as well as the crystal oscillator-cum-divider IC operate on 9V supply (actual operating range: 7 to 11 volt), a battery back-up system can be used to keep the clock running during mains failure. There will be no display of time while the clock is running on this back-up system, but on the resumption of power through AC mains the clock will automatically display the correct time. If due to any reason supply to the clock chip is cut off, all the digits will flash at 1Hz to indicate that time displayed is incorrect.

Assembly

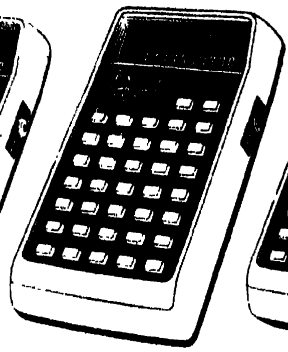
The prototype for this clock was assembled in a two-colour acrylic sheet cover which is perhaps the best material available for this purpose in our country. The clock may, however, be given any shape to suit the individual taste.

Since almost all the clock LSIs are MOS or CMOS devices, handling precautions (see EFY, Nov. '78, p. 61) are required to be taken at every stage. The best way is to use sockets for the ICs. The sockets are now made in India, including the 40-pin type for IC2. In the prototype, 40-pin 'Micronics' and 8-pin 'Gilard' sockets were used. Further, all the pins of ICs should be kept shorted by metal foil or wire till actual placement in wired sockets. Care should also be taken not to remove or insert an IC in the socket when power is 'on'.

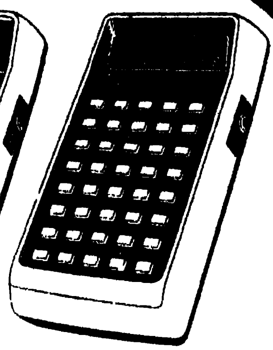
Current requirement for the clock chip is of the order of



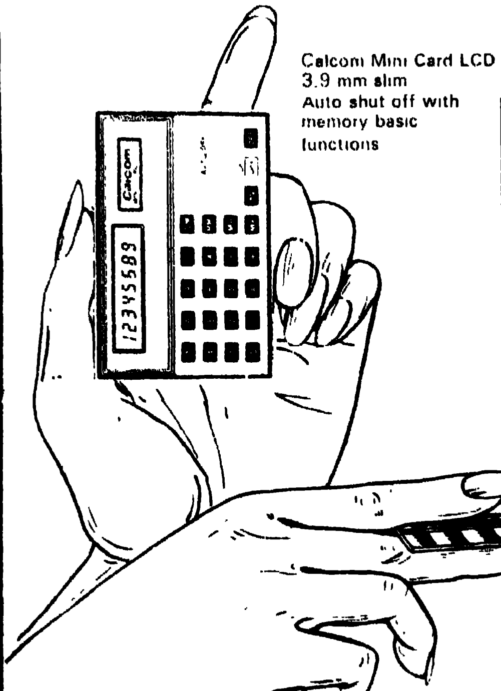
Calcom 29
Scientific with one memory



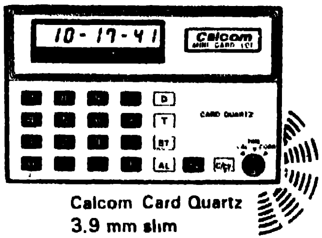
Calcom 31
Scientific 8 + 2 digits, 2 level parentheses, one memory, DMS, P→R functions



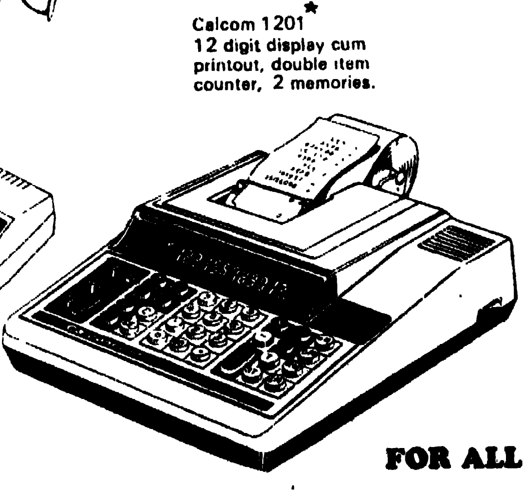
Calcom 32
Advanced Scientific 8+2 digits, 2 level parentheses one memory, DMS, Polar to Rectangular functions, Statistical features.



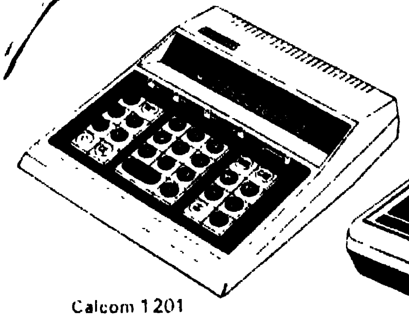
Calcom Mini Card LCD
3.9 mm slim
Auto shut off with memory basic functions



Calcom Card Quartz
3.9 mm slim calculator cum alarm clock with hour, minute, second display and day, date, 24 hour alarm/hourly beeps. Super long 8000 hours battery life.



Calcom 1201*
12 digit display cum printout, double item counter, 2 memories.



Calcom 1201
12 digit AC/DC general purpose, one memory.

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banishes proprietor and Customer fatigue
the ultra slim mini card LCD electroni
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soft keys and auto shut off. or the car
quartz which is 3.9 mm ultra slim calcu
lator plus alarm clock with hour, minute

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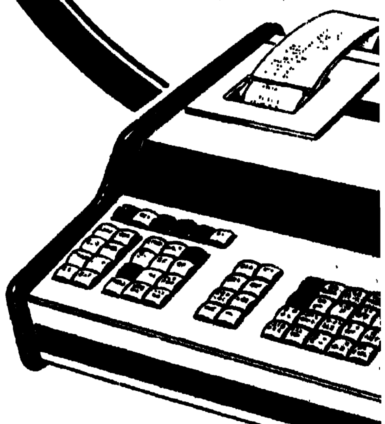
BOMBAY 400009

207, MAHARISHI DEBENDRA
CALCUTTA-70007



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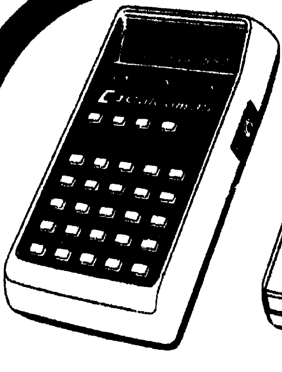
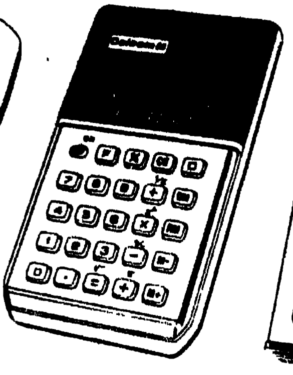


Calcom 35
Scientific Programmable
8 + 2 digits, 102 step
program memory.



Calcom 26
Smart, Elegant,
8 digit,
calculator

Calcom 26★
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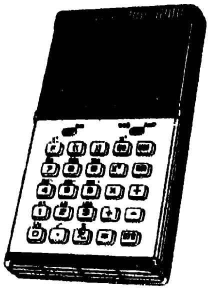
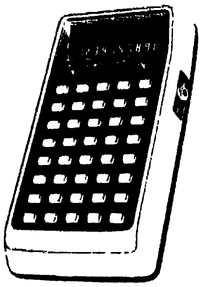
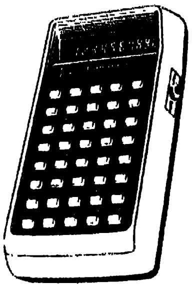
Ultra high reliability calculator with
4 key memory, Pi, square root,
I/X and % functions.



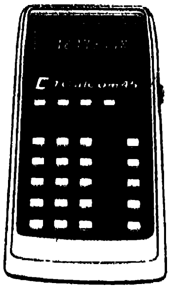
Calcom 28
5+2 digits scientific,
2 level parentheses,
one memory



Calcom 30
Scientific 5+2 digits
with 8 digit accuracy,
one memory and DMS
function



Calcom 33
Advanced Scientific cum
Statistical 8+2 digits,
4 level parentheses, 10
memory registers, 67
direct functions.



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Programmable
8 digit, 102 step
program memory.

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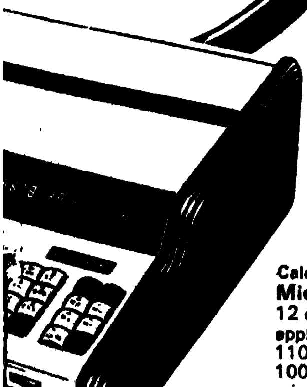
Scientific cum Statistical,
67 functions, 10 registers,
4 level parentheses, 72
steps of key stroke
programming; AC/DC



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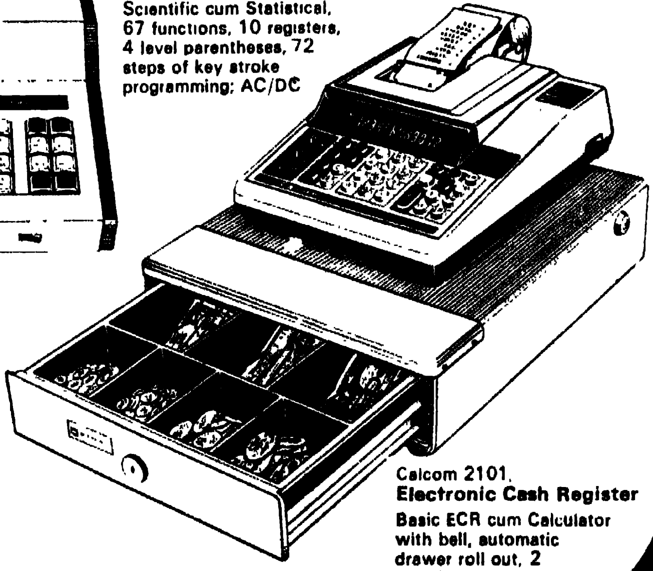
1000 program memory steps,
printer, mini cassette
transport, expansion
capability.



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protection option.

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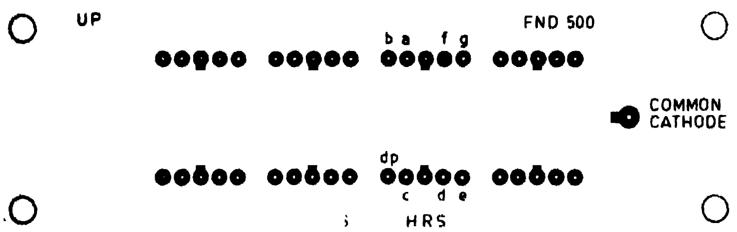

Fig. 5: Components placement diagram.

4.5 mA, for the crystal oscillator-cum-divider it is 1.5 mA, and for the display it is 250 mA. Since the current drain for the clock counter is only 6 mA, the 'Eveready 216' battery was found most suitable (for short load sheddings), since its specified continuous drain is about 96 hours. However, where load shedding is frequent, 'Eveready 266' is a better proposition.

Since the clock is meant for a continuous operation from AC mains, the transformer used should be of a high quality and rated for at least 700 mA. ☐

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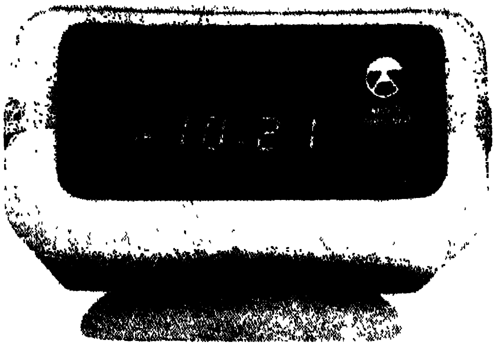

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- AM & PM indication.
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- Soft blue fluorescent read-outs. Also serves as a night lamp.
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The Functioning of DIGITAL CLOCKS AND WATCHES

G.L. Kataria

Digital clocks and watches stand next only to pocket calculators in popularity among the digital consumer items. A wide variety of models with numerous options and features have flooded the market. Because of stiff competition among the international manufacturers, watches and clocks have come up with some very unusual combinations. One such combination watch works as a scientific calculator besides displaying time when not in use as a calculator.

The first of digital electronic watches to hit the consumer market were based on LED (light emitting diode) type display. In these the display normally remains off though the time keeping function is continuously active. To check time one has to press a small push-button switch on the side which activates the LED display. The display is normally kept off to conserve the power drawn from the tiny cells used, as LED displays require relatively more power when in use. Because of the simple reason that the user has to push the switch to see time such watches did not become very popular.

The digital electronic watches industry, however, picked up with the introduction of continuous display type watches based on LCD (liquid crystal display) technology. LCD displays require very little power for operation and have therefore found a wide application in digital watches and clocks. These watches and clocks do not require frequent replacement of cells, as is required in the case of those using LED displays. Currently most of the digital clocks and watches being made are of LCD type with of course numerous other features like seconds display in addition to hours and minutes, alarm facility, stop-watch facility, calendar facility etc.

As far as the time control function is concerned, all the digital electronic clocks and watches are based on the same basic principles. The block diagram of a typical digital watch/clock is shown in Fig. 1. It incorporates various functions which can be commonly seen in the numerous models available. In cheaper models some functions may not be there, and so in such cases the blocks shown for such functions may be taken as missing in the system.

As shown, the first and the foremost block is that of the frequency source which acts as the reference frequency standard on which the clock/watch system is based. Such a source could be either the AC mains frequency, an RC

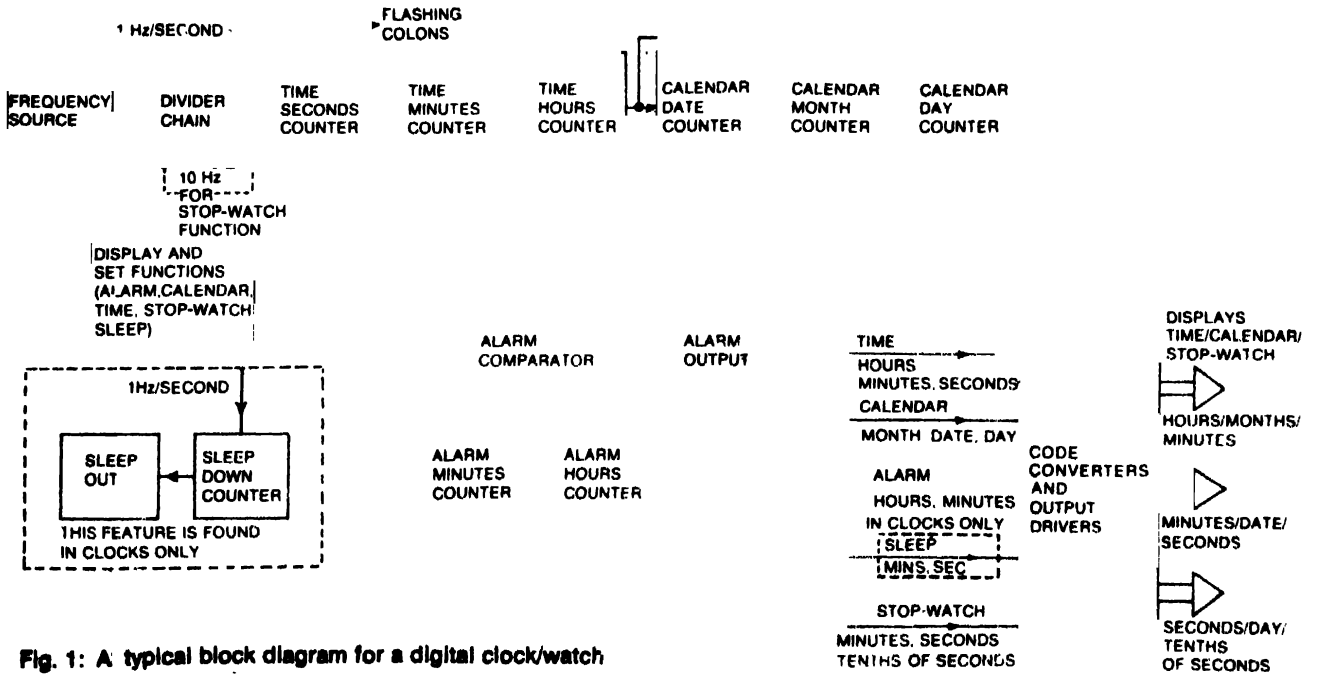


Fig. 1: A typical block diagram for a digital clock/watch

oscillator, or a quartz crystal oscillator, in case of a digital clock. The digital watches are only quartz crystal controlled.

The accuracy of the clock/watch depends on the type of frequency source used and its stability. Quartz crystal oscillators are of course the most stable and accurate as far as the frequency is concerned.

Next in accuracy is the AC mains frequency which is fairly constant when averaged over a 24-hour cycle, though a variation of ±2 Hz to ±4Hz at a time is not uncommon. Errors can result in the clock functions if the mains frequency remains continuously high or low throughout a day. However such occasions are quite rare because there is every likelihood of the mains frequency varying both ways in 24 hours.

In the case of clocks dependent on the AC mains supply, an alternative frequency source is generally provided which automatically takes over in case of a power failure. RC oscillators are normally incorporated in these digital clocks as the alternative frequency source only, and take over in case of mains failure. As such, the smaller is the period of mains failure, the less will be the error introduced in the clock's timing.

Next to the frequency source comes the divider chain which divides the reference frequency to give an output of 1 Hz to be used as the basic input to the time counter chain and 10 Hz (or 100 Hz in some quartz controlled watches) for the stop-watch function. The 1Hz output is also used to drive the colons so as to flash them continuously like the 'tick-tock' of mechanical clocks and watches. It is also used for advancing the displays used in any of the modes, such as time, alarm, calendar etc while setting for such functions. In some cases the set rate is kept at 2 Hz or 4 Hz.

The seconds counter is a divide-by-60 counter which will deliver an input pulse to the minutes counter after every 60th count or the completion of 60 seconds. The minutes counter is also an identical stage which divides by 60 and delivers an input pulse to the hours counter after the completion of 60 minutes. The hours counter is either a divide-by-12 stage (when 12-hour format is used) or a divide-by-24 stage (if 24-hour format is used). With this stage the basic clock function is complete, and so these are the bare minimum stages required in the cheapest variety of clock or watch. Additional counters are required to have the calendar function.

The date counter and the day counter are made to advance after every 24-hour count, i.e. on the completion of one complete day. The month calendar is made to advance after the completion of the requisite number of days, depending on the particular month. In fact, the month counter and the date counter work in conjunction. The months January to December are designated and displayed in the respective sequential order as one to twelve and thus, depending on the month, the date counter is made to count up to only 28, 30, or 31, as required, and start afresh with the change of the month. The month of February is assumed to have 28 days only, irrespective of the leap year. Thus, in the leap year, when February has 29 days, the user will have to readjust the clock/watch for the additional day.

The 'display and set functions' block comprises the stages which through the help of switches provided connects the common 4/6 digits to the alarm counters (also to sleep counter in clocks) or calendar counters, or make the unit to work as a stop-watch. In addition, the various adjustments in time, calendar, alarm etc are also done through this block, whenever required. Calendar and time adjustments are not required frequently, except when the cells or batteries used get exhausted, or after a mains failure (if no switchover arrangement to an alternative source is available).

However one has to adjust the alarm counters to the desired time, as and when required. In clocks/watches using 12-hour format, in order to make sure that the alarm time set is for the particular hour in the a.m. or p.m. duration, normally an a.m./p.m. indication is also provided. Whatever alarm time has been set in the alarm counter, the information is fed to the 'alarm comparator' block which compares this information with the normal time in the time counters. Once both these tally with each other, the comparator activates the alarm output and an audible indication alerts the user of the alarm. In some models there are options of up to four different alarm time settings.

The last block is that of the code converters and output drivers. Normally, as only four or six digits are used for displaying time, calendar, sleep time, alarm time, stop-watch etc, at a time only one respective group of counters has to be connected to the displays. The code converters and output block, in conjunction with the display and set functions block, ensure that only one function is displayed at a time when the appropriate push-button is pressed. □

Have You Any Idea?

Do you have any circuit idea which you feel is worth sharing with the other EFY readers? If so, please do put it down neatly on a piece of paper and mail it to. The Managing Editor, Circuit Ideas, Electronics For You, 303 Dohil Chambers, 46 Nehru Place, New Delhi 110019

A token honorarium (minimum Rs 25) will be paid for the ideas found acceptable for publication But please see that your contribution fulfills the following two conditions:

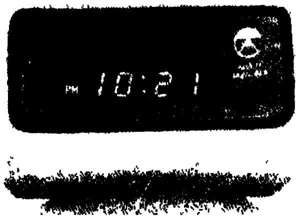
1. It has not been copied from some published material.
2. The circuit has been tried by you and was found to work satisfactorily

Buyers' Guide for Digital Electronic Clocks

Given below are the salient features of some of the digital electronic clocks being assembled in India. Since models and their features are liable to change, it is suggested that the latest information is obtained directly from the manufacturers, whose addresses are listed under the directory, before placing a firm order with them.

Advance Electronics

'Multi Digi-Glo' table model; 4-digit green fluorescent display; quartz oscillator frequency source; 230V AC mains operation with battery (2x9V) back-up facility; alarm and snooze alarm facility; seconds display; a.m./p.m. indications; calendar adjustment only once in four years.

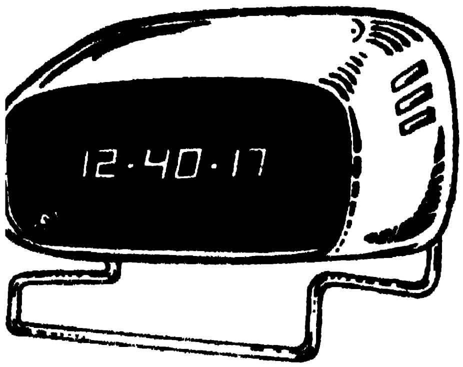


Akay Electronics

'COSMOS' auto-clock; 4-digit green flourescent display (3/4 cm high); crystal oscillator time base; 12V DC operation—time keeping maintained down to 9V; protected against voltage transients and voltage reversal; to prevent tempering the time setting switches are disabled when the auto ignition and the clock's display are both off. Price: Rs. 440, including all taxes.

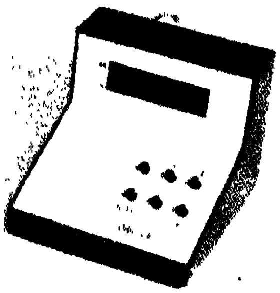
Ashok Electronics

Electronically regulated and crystal controlled clocks available in various models (assembled and kit form) for desk, automobiles, walls, industrial and road-side use; details on request.



Continental Digitronix

'Digitek-21' table model; 4-digit (1.6cm) LED display; crystal controlled time base: 230V AC mains operation with battery (9V) back-up facility; seconds display on command; alarm and snooze alarm facility; a.m./p.m. indication; colon blinking at 1Hz, power and battery failure indications. Price: Rs 550, ex-factory.



'Digitek-31' wall clock has all the features of 'Digitek-21' except alarm and snooze arrangements. Price: Rs 520, ex-factory.

Electronix India

Centrally controlled electronic digital clock; master clock can drive up to 10 clock displays; has battery back-up facility; industrial alarm and card punch coupling facilities; 2.5cm display suitable for rooms—priced Rs 400; 10cm display suitable for halls—priced Rs 1,200; master clock—priced Rs 5,000.

Emco Electronics

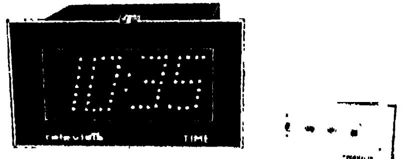
Standard digital clock 'EE 602 S' runs on 230V AC mains but has standby power supply with self-charging system; internal 100kHz crystal controlled frequency standard; displays hours, minutes and seconds in 24-hour format with 1.25cm green fluorescent digits; if both mains and standby supplies fail a flashing light indicates that the time displayed is incorrect; multi-display driver unit can be used for high voltage larger displays; programmable time alarm system; BCD output for time; 7-segment outputs for multi-display.

TNK Electroniks

230V AC mains operated table model with 9V battery back-up; 1.25cm display; 24-hour alarm and snooze alarm facilities; a.m./p.m. indication; seconds display mode; 59-minute sleep counter; selectable 12/24 hours operation. Price: Rs 650.

Televista Electronics

Digital clocks and master slave systems for use in TV and radio stations, airports, railway stations etc; four-digit (hours, minutes) and six-digit (hours, minutes, seconds) types with large (15mm to 100mm) 7-segment LED displays; quartz crystal time reference; AC mains operation with battery back-up; day/date calendar facility and alarm. ☐



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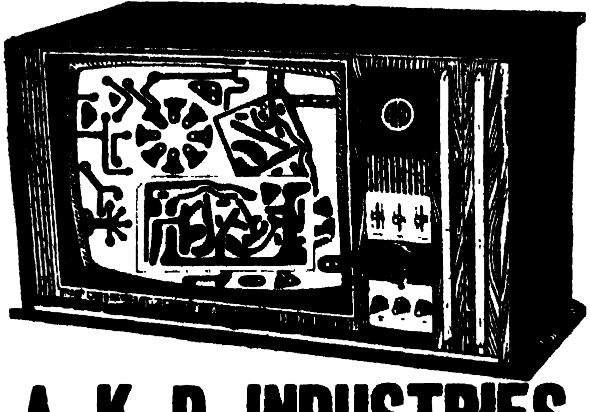

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Soldering Techniques (Part 1)

Devendra K. Soni

Though soldering is one of the oldest metallurgical techniques, its importance has only increased with the passage of time and advent of new technologies. Even today all electrical and electronic components and assemblies required to be joined electrically are soldered, as soldering has remained a comparatively cheap and simple technique.

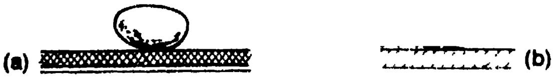

Fig. 1 (a): Solder on to non-metallic or unclean surface
(b): Solder on to clean metallic surface

Wetting

A drop of molten solder dropped on a non-metallic or an unclean surface forms a round ball, like a water drop on a non-porous surface. This is illustrated in Fig. 1(a) while Fig. 1 (b) shows molten solder on a clean solderable base metal. In the latter case the solder has been able to 'wet' the base metal, and the secret of good soldering is the ability to properly wet the base metal with the solder.

Under the normal conditions, however, both the base metal and the fusible solder alloy have a thin film (of tarnish) on their surfaces which does not permit a proper wetting of the surfaces. This film is produced by environmental attack on the metal and consists mainly of oxides, sulphides and carbonates and other corrosion products.

The removal of this film is a basic function of fluxes. Since the films are insoluble in any of the conventional solvents, and cannot be removed easily, like grease, they are reacted upon chemically with materials which produce compounds soluble in the liquid flux.

A good quality flux must have the following properties:

1. It should be capable of withstanding soldering temperatures without evaporating or breaking down.
2. It should be capable of properly wetting the base metal.
3. (a) It should have low corrosivity at room temperature, if any; (b) it should emit low corrosivity fumes during soldering; and (c) it should leave a low corrosivity residue, if any.
4. It should act as a heat transfer medium from the heat source to the solder and the workpiece.
5. It should provide reducing cover or at least prevent the access of atmospheric oxygen to the newly cleaned surface.
6. It should be made of non-irritating materials and give off harmless fumes only during soldering.
7. It should have a high flash point to prevent explosion in the case of overheating.

The fluxes used in soldering can be divided mainly into two general categories: (i) organic fluxes, and (ii) inorganic fluxes. Those required for electrical and electronic work are mainly organic fluxes. And they are generally resin-activated by addition of specially selected amino-hydrochlorides so that cleaning of electrical connections after soldering is not necessary.

By far, most of the soldering work is carried out by hand with a soldering iron or a soldering gun. Flux is also available in the form of paste besides being included in resin-cored solder wire, as shown in Fig. 2. For wave soldering and dip soldering, usually a liquid flux, the solvent being isopropyl alcohol, is used.

Solders

Though there are various alloys used as solder, it is out of the scope of this article to discuss all of them in detail. We may, therefore, restrict ourselves to the 'soft solders' only which are popular for electrical and electronic connections. Soft solder is essentially an alloy of tin and lead in different proportions:

It is worth noting the following facts about these two metals and their alloys:

1. Tin is not attacked by air or water and thus has a high corrosion resistance.
2. Lead is soft and dense, but highly prone to corrosion. Thus, in normal environmental conditions, it tarnishes rapidly. However once a tenacious layer of corrosion has formed, the environmental attack on the metallic lead ceases as the corrosion layer protects the metal from further corrosion. As long as the corrosion layer is tenacious and non-soluble in the media, the metal surface underneath remains protected. As the tarnished surface of lead is not affected by water, the metal (lead) can be used satisfactorily in most environments.
3. Tin alloys with a metal very easily, but requires a high melting temperature to make solder. And it is costly.
4. Lead when alloyed with tin, reduces its melting temperature and adds to the overall strength of the alloy. It also moderates the action of alloying to the base metal.
5. Tin is good in wetting while lead is poor. Their com-

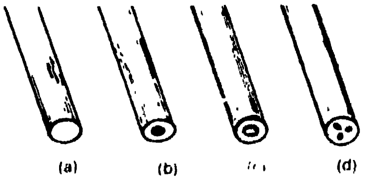

Fig. 2: Types of solder wire with flux: (a) solid wire, (b) cored solder, (c) cen-tri-core, and (d) tri-core

bination in different proportions provides varying degrees of wetting, economy of product, melting temperatures and hardness.

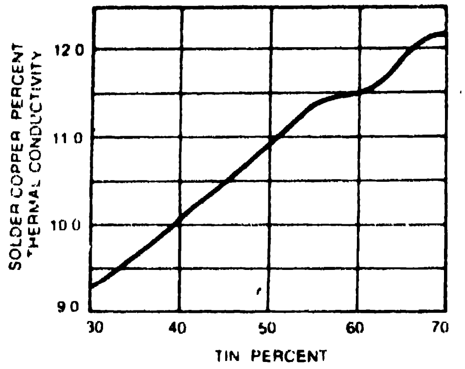

Fig. 3: Thermal conductivity as a function of tin content

The proportions of tin and lead in solder are expressed in a ratio. A 60:40 solder has 60 per cent tin and 40 per cent lead.

A solder sometimes contains traces of metals such as bismuth, copper, zinc, magnesium and antimony for giving it some special characteristic. Since percentage of these metals is generally very low, they are not generally accounted for in the ratio. Following are some common tin/lead ratios for the solder and their uses.

Ratio (Tin:Lead)	*Uses of the Solder*
70:30	Good for pre-tinning, costly.
63:37	Eutectic solder, the best solder as it has no pasty state.
60:40	Good general-purpose solder.
50:50	Low-cost general-purpose solder.
45:55	Used for hermetic sealing.
40:60	Common solder.

Ideally, a solder should have the following qualities:

Wetting : The solder should have a good capillary action so that it may fill in the space between the two metallic surfaces properly and join them together properly.

Melting temperature: The solder should be able to melt and wet the base metal at as low a temperature as possible, consistent with its other properties. This will ensure that the delicate electronic components to be soldered will not get damaged in the process. Melting temperature is dependent on the amount of tin in the solder. The curve in Fig. 3 shows thermal conductivity of solder as a function of tin content.

Strength : The tensile strength and the shear strength of a solder are sufficiently high if it contains a composition of tin/ lead in-between 40:60 and 90:10. It should, however, be remembered that the primary purpose of soldering is not to secure good tensile and shear strengths in connection, but to form a permanent electrical connection with the optimum environmental characteristics.

Electrolysis: When two dissimilar metals are dipped in an electrolyte (which may be moisture of any kind), a galvanic corrosion starts. This is also known as electrochemical corrosion. As a matter of fact, a galvanic couple is formed which is short circuited on itself through the electrolyte. The metal of higher potential becomes the anode and tends to corrode. With specific regard to solder, this can result in decreased electrical conductivity and weakened physical condition.

Creep : Creep may be defined as a time-dependent deformation which accompanies the application of a stress or combination of stresses to a solid.

Good soldering technique

The following few steps must be observed in order to ensure soldered joints of low electrical resistance and high mechanical strength.

1. Utmost cleanliness
2. Good mechanical connections before soldering
3. Use of proper flux for the job
4. Use of proper solder alloy for the job
5. Proper temperature
6. Proper timings
7. Good inspection and cleaning

One must also keep in mind that rosin is the only flux that gives long life, and freedom from corrosion and noise. Hence, only rosin fluxes are recommended for electronic assemblies.

To be continued next month.

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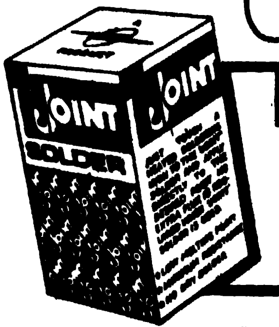

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DESIGNING STEREO TAPE RECORDERS —SOME POINTS

A. S. Sharma

Since a stereo deck is supposed to form a part of the high-fidelity paraphernalia of a musical cognoscente, its technical specifications have to be more rigid compared to that of a mono cassette tape recorder meant for the entertainment market. Mono cassette tape recorders use small speakers, around 90mm in dia, in which low frequency response is very poor and one need not worry about hum problem. In the case of a stereo recorder using external high fidelity speakers for playback, the low frequency response has to be very good and hum level must be extremely low. Output of a stereo magnetic head is 6 to 10 dB lower than that of a mono head. To achieve a comparable signal-to-noise ratio it is essential therefore that the equivalent input hum and noise should be lower in the same proportion.

In stereo operation the defects of reproduction become more obvious, the basic operation of the deck therefore becomes more critical. Frequency response of the reproduction system has to be wider, and harmonic as well as inter-modulation distortions should be low. In the case of a tape recorder, circuitry is definitely not the limitation. The frequency response limitations arise because of the limitations of the head characteristics and the tape. The circuit response can fortunately be manipulated to make up for the head and tape deficiency. Care must, however, be taken that noise and distortion do not go up beyond tolerable limits. Even if it does not look impressive on paper, a limited frequency response is preferable to a wide but noisy response.

It used to be quite a feat to design a valve amplifier using transformers all-over and achieve a good frequency response versus gain. With transistor amplifiers, and no transformers, deviations in the characteristics desired become more important.

Fig. 1 shows the characteristics of a stereo head. It may be noted that response drops sharply at the lower frequency end, limited by the self-inductance of the head, and also at the higher frequency end, limited by the head gap width. To get a reasonably good reproduction from the equipment it is essential to see that frequency response is improved without increase in noise level from the circuitry. Of course, the noise level in the system at the higher end is affected by the tape hiss. Well, with the best of the heads available today, and the low-noise tapes used with the noise reduction circuits, it is quite possible to get a system response flat to 20,000 Hz with a cassette deck.

Normally, the low-frequency compensation is provided during playback to avoid saturation of the magnetic head by high level of the low-frequency signal due to limited self-inductance of the head during recording. For the highs, pre-emphasis is provided during recording, partly after the amplifier chain; part of the feed resistor to the head is shunted by a capacitor to increase the level of the highs at the head. During playback, the de-emphasis of the highs in the preamplifier brings down the highs to the desired level. The high frequency response also depends on the bias frequency and the bias level during recording.

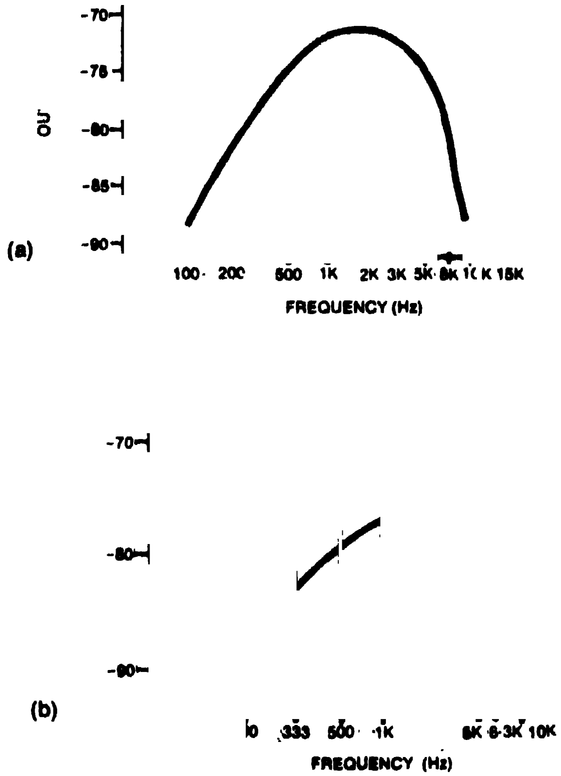

Fig. 1 (a): Record playback frequency response
(b): Playback frequency response

Tape hiss is the limiting factor for an expanded high frequency response. Recently a number of noise eliminating circuits have been developed. The best circuit for the purpose is Dolby B system, which is now being incorporated in most of the stereo decks produced around the world. JVC Nivico's ANRS, basically developed for their

CD-4 quadraphony system, works on similar principles, and it is totally compatible with the Dolby B system. Philips did bring out Dynamic Noise Limiter (DNL), which being open ended had its limitations, but now as a licencee of Dolby, Philips also uses the Dolby B noise eliminating system.

The electronic circuitry of a stereo cassette tape recorder's deck consists of:

(a) Preamplifier, which also includes frequency response corrective networks.

(b) Amplifier to provide required signal for the output section, but may not be always there.

(c) Output amplifier to provide the signal to recording head during recording to headphones/output terminals for external amplifier, and to the metering circuit which is of particular importance during recording to keep the signal within desirable limits to avoid everloading of the amplifier circuitry or saturating the magnetic head.

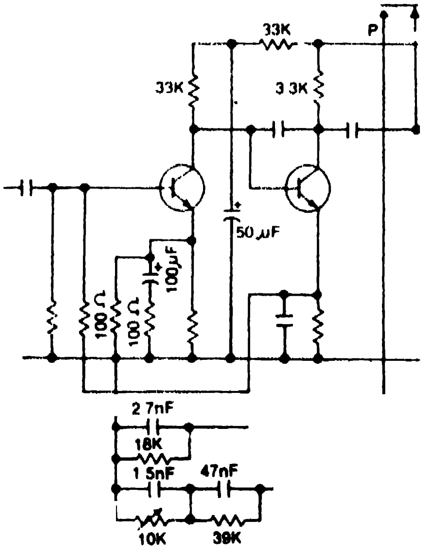

Fig. 2 (a): Preamplifier with feedback networks. National.

(d) Bias oscillator—stereo decks are invariably operated on AC bias for recording as well as erasing operations.

(e) Power supply in which an electronic filter is sometimes used to keep the hum level low; the motor may as well be electronically governed to obtain stable speed over a wide range of supply voltage.

Preamplifier

Use of a direct-coupled transistor pair is common for the preamplifier stage. Because of the heavy DC feedback from the emitter of the second transistor to the base of the first to provide biasing current, DC operating points of the two transistors are very stable. This is particularly essential as the input transistor must operate at a very low current to achieve low-noise operation essential for amplifying signal as low as 80 microvolts for each channel from the head during play. Normally, transistor noise is not the limiting factor in these circuits.

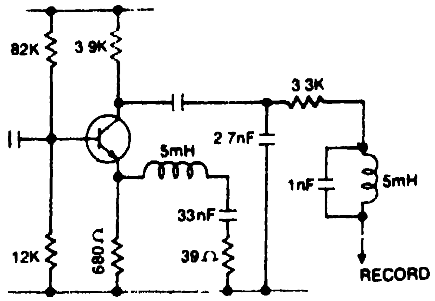

Fig. 2 (b): Output signal for recording head. Series tuned peaking LC network in emitter circuit. Parallel tuned circuit for suppression of bias signal. National.

Feedback networks have basically two functions: stabilisation of the gain at the desired level and shaping of the gain frequency curve to the required shape. Frequency corrective networks have two functions: to provide the pre-emphasis on high frequency during record and de-emphasis on highs during playback. This improves the signal-to-noise ratio, noise being mainly tape hiss. Secondly, the head characteristics must be compensated for (see Fig. 1) record/playback characteristics of the head. Networks coming into play during playback also compensate for the low frequency characteristics of the head, and final reproduction can have wider frequency range.

During recording, boosting of low frequencies in the preamplifier or, for that matter, in active stages is avoided to prevent the later stages of amplifications being pushed into saturation by the boosted signal. High-frequency pre-emphasis is provided in the path from the output to the head by an RC combination which provides the current for the record head. There is no boost of the lows during recording as low-frequency signal could easily drive the head into saturation because of the limited inductance of the head. As it is, the signal normally has a higher proportion of lows compared to highs. In certain circuits high-frequency boost has been provided in the later stages by a

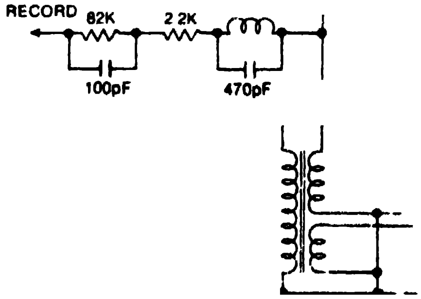

Fig. 2 (c): Output signal for recording head; note the pre-emphasis network and parallel tuned circuit for suppression of bias signal series peaking network used as bypass for the emitter resistance.

Normally, AC bias is applied directly at the recording head and a parallel LC tuned circuit is used in series with the pre-emphasis network to prevent breakthrough of the bias signal into the audio section. This can be a major problem in high fidelity equipment with extended frequency response. Today, power amplifiers with frequency response much beyond the bias oscillator frequency of 40kHz or 60 kHz are fairly common. Sony, for instance, has been using a frequency of 100 kHz to overcome this problem and to extend the frequency response of the tape unit itself. Heads are designed to operate with a specific bias oscillator frequency, and hence this frequency cannot be chosen arbitrarily by the circuit designer. Well, it is natural that the manufacturers who make their own components can use the custom-made components for obtaining the best performance from the circuit. In fact, the equipment design starts with the components design.

Low frequency is compensated for during playback only by feedback network in the preamplifier. 3dB points of overall amplitude response of a home cassette tape recorder should be at 80 Hz and 6300 Hz. To achieve this, 13 dB increase in treble is provided during record and 17 dB boost in bass during play. Considering the large amount of boost at low frequency, it is essential that hum level at the input is controlled to minimise hum at the output.

With wide availability of pre-recorded cassettes, it becomes essential that replay characteristics follow standard practice so that the pre-recorded cassettes sound the same on all equipment. With availability of chromium oxide and other better quality tapes, with improved high frequency response and low noise, de-emphasis networks are provided with 70μS for the normal tapes and 120μS for special tapes. Extended frequency response up to 20 kHz can now be achieved on better quality decks.

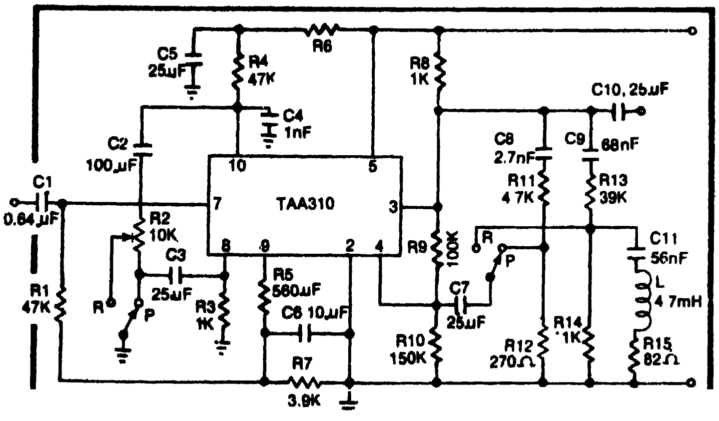

Fig. 3 (a): Circuit diagram of recording and playback amplifier using TAA310 IC, switch in play position

Fig. 2(a) shows a typical circuit (National) using direct coupled transistor doublet. Fig. 3(a) shows a preamplifier circuit using TAA 310 Philips IC. Fig. 3(b) shows the no-load voltage of playback head as a function of frequency and Fig.3(c) shows the frequency response characteristics of record and playback amplifiers. 10kHz peak for recording is obtained by LC circuit. Fig. 2(b) shows an output stage with series tuned peaking LC circuit as emitter resistor bypass, 3.3k resistor in series with output decides recording current level. Parallel tuned circuit, LC—5mH and 1 nF, reflects the bias signal.

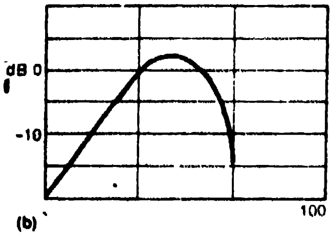

Fig. 3 (b): No-load voltage of playback head as a function of frequency

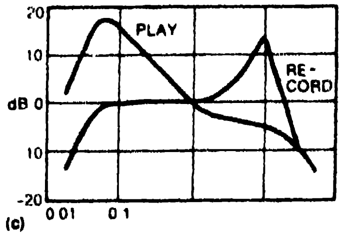

Fig. 3 (c): Frequency response characteristics of record and playback amplifiers

Amplifier

With the output signal from head about −82 dB and the dynamic microphone signal output about the same, overall gain required of the equipment is about 90 dB. Part of this gain is provided by the preamplifier and part by the amplifier—gain contribution of the final stage may often be nominal. If the output is emitter follower, the gain is unity. Even otherwise, the gain is low with low collector impedance.

Amplifier stage may consist of single or two transistors. Quite often the output section may provide the additional gain and the frequency compensation, if necessary.

Output stage

Emitter follower configuration is common at the output in stereo decks; this provides the signal for recording. High impedance headphones may load the emitter follower directly; provision for low impedance headphones is through a matching transformer. Fig 2(b) shows the output stage for recording signal. The peaking coil bypasses the emitter resistance. Parallel tuned filter to block the bias signal is in series with the output. Fig. 2(c) shows the section of the output for recording signal; it also shows the pre-emphasis network and blocking filter for the bias signal. Circuit shown in Fig. 2(b) is that of National deck and that shown in Fig. 2(c) is of Nivico stereo tape recorder. Nivico's circuit is complete with audio output stage. It is probably an earlier model. The output stage is transformerless and uses a complementary transistor pair, yet transformer has been used at the output to match the loads. The use of transformer could have been avoided. Use of matching transformers for headphones is quite common. Metering circuit would also normally come across the output.

Bias oscillators

Because of the higher frequency band and critical requirements of tape-deck, the bias oscillator requirements become critical. It is more common therefore to use a pushpull oscillator as the waveform from it would be less distorted compared to that from a single transistor circuit. Lower distortion means lower harmonic content, which is an advantage when the deck has to be used with a tuner or a radio receiver. The harmonics can interfere with reception and create disturbance. Besides, preset pots are invariably used in case of tape-decks to set the recording bias, to achieve the best possible high frequency response.

It should be noted that in case of cassettes, the first and the second channel form the stereo pair and not the first and third as in case of reel-to-reel tape recorders. As such, the erase head for mono and stereo systems are the same.

Fig. 4(a) shows a single transistor oscillator circuit providing the erase voltage and the record bias for two channels. Figs. 4(b) and 4(c) show oscillator circuits using transistors in pushpull operation. Fig. 4(c) shows a coilless circuit using a complementary pair of transistors. Effectively, it uses erase head itself as a part of the oscillator circuit, the frequency of oscillation of which is therefore decided by the inductance of the erase head. This would, of course, make the replacement of the erase head difficult, as a near equivalent could change the frequency of oscillation.

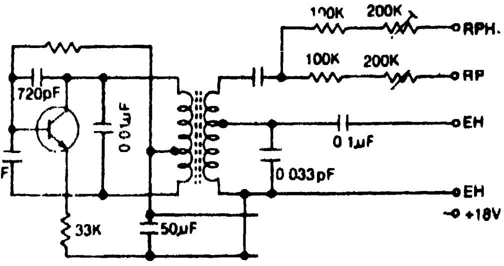

Fig. 4 (a): Single transistor bias oscillator

To get the best high frequency reproduction, record bias should be adjusted properly. The normal procedure followed is to insert a low value resistor in series with record head on the earth side and monitor the voltage drop across the resistor. The preset potentiometer is adjusted to get the rated bias current for the head, as indicated by the voltage drop across the calibrating resistor.

Power supply

Except for those meant for car operation, all stereo decks operate off AC mains. As indicated earlier, it is essential to control hum level in case of stereo cassette decks because of lower output from the magnetic head and smaller track width. Apart from the use of electronic stabilisation to reduce hum in the supply for low level signal stages, care in the design of the printed circuit board and component layout is essential. Undesirable earth loops can be more of a problem, introducing instability and hum into the circuit.

Automatic level control (ALC) is now more or less standard in case of mono tape recorders. In case of stereo decks, ALC is sometimes provided with the facility to switch over to manual control of the recording level. Use of independent ALC for the two channels would affect the stereo character of the recording. Hence the ALC voltage is combined and both channels are controlled by the predominating voltage so that the stereo character is maintained.

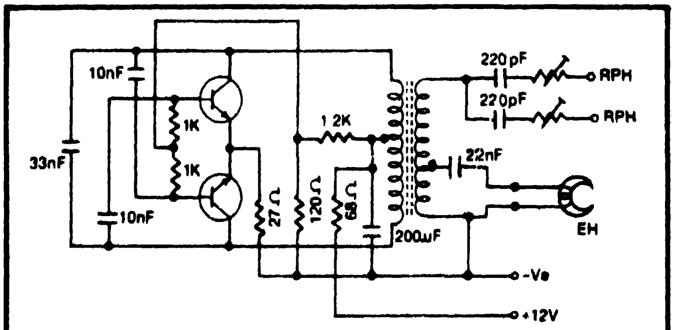

Fig. 4 (b): Push-pull bias oscillator

Tape hiss has been a major problem affecting the quality of the recording and its dynamic range. Most of the stereo decks now have Dolby facility for use, if desired. As the facility can be incorporated under licence from Dolby Laboratories Inc. only, the circuitary used by most of the manufacturers is nearly identical. ICs for Dolby B system have become available now.

Operation of JVC Nivico's ANRS is very similar to operation of Dolby system, and they are compatible. Both provide high frequency boost during recording and reduction on playback to obtain the original level of the highs in relation to low frequency signal. In operation it appears to be very similar to the normal pre-emphasis and de-emphasis used in tape recorder circuitry. However, in case of Dolby B, the pre-emphasis during recording and the turnover points of the frequency curve of pre-emphasis are made dependent on the high frequency content of the input

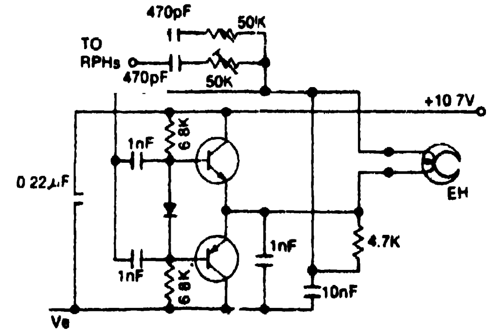

Fig. 4 (c): Bias oscillator using complementary pair of transistors. Erase head is part of the tuned load signal. In case of adequate highs there may not be any processing of the signal. Weaker the signal, greater the enhancement during recording and over a larger band. When the highs content goes below 40 dB with respect to the reference, the pre-emphasis starts from 500 Hz and as much as 10 dB improvement in signal-to-noise ratio can be obtained (Fig 5).

Play-only unit

Play-only stereo units have become very popular, particularly for the car market. Most of these can be used indoors with external power supply. These operate normally on 12V supply. The power output is quite adequate for average urban rooms. With tape cassette decks available in the country, and production of pre-recorded cassette tapes picking up, it may be worthwhile for a hobbyist to assemble his own play-only unit. It would be easier to assemble as the electronic assembly can be kept away from the deck,apart from wiring to the head and of course the motor circuit.

We would need dual power supply—6 volt for the motor and around 12 volt for the circuit to obtain an adequate output. It would be preferable to operate the motor at around 7.5V to maintain good quality operation with wide variation of supply from mains. In India, the available mains voltage is normally substantially lower. If motor supply is taken as 6V nominal for 230 volt supply, a variation in speed would be experienced with the voltage going below 4.5V. Separate transformers may be used for motor supply and the circuit; easily available 6V transformers for main operation of cassette tape recorder can be used for both. These are normally available with a centre-tapped secondary. A full wave circuit can be used to get 6V supply for the motor and a bridge circuit to get 12V supply from a similar transformer.

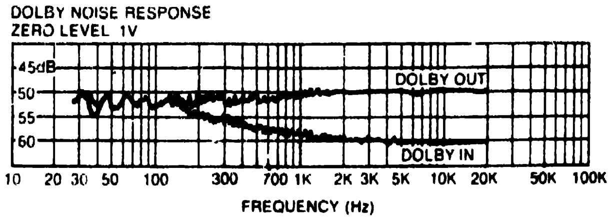

Fig. 5: Noise spectrum with and without the use of Dolby B system

The circuit may consist of a preamplifier with frequency corrective feedback network, followed by a volume control and power output circuit. A transformerless four-transistor output circuit using BC158, BC148 and AC187/AC188 matched pair would be adequate. If desired, a Baxandal type tone control can be inserted before the power amplifier. As the nominal gain at 1 kHz for the tone control is unity, its insertion in the circuit would not change operating conditions otherwise.

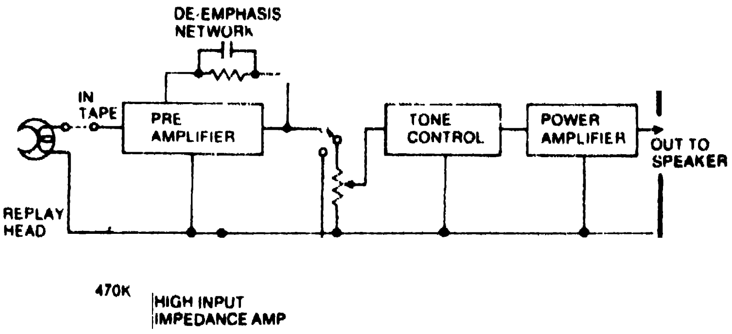

Fig. 6: Play-only stereo unit—only one channel shown

If desired, one can add a bootstrapped circuit through a switch before the volume control to use the equipment as a record player amplifier. The circuit can be used as a tape recorder amplifier with the signal from the head being fed to the preamplifier, volume control and power amplifier. As a player amplifier, output from the pick-up would be fed to the bootstrapped amplifier, output of which is fed to the top of the volume control—the preamplifier being switched out of the circuit. 12-volt operation for the power amplifier would provide an output of over 1 watt RMS each channel. Used with 15cm speakers or 15cm by 10cm speakers common in TV receivers, adequate output would be available. □

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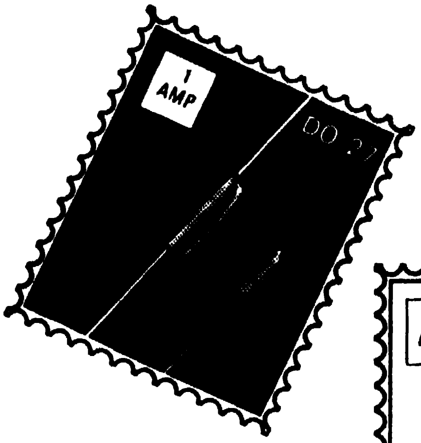

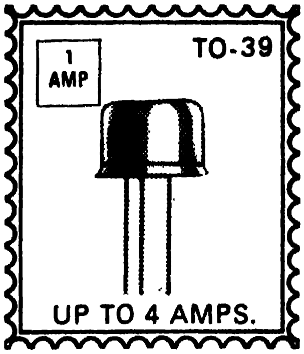

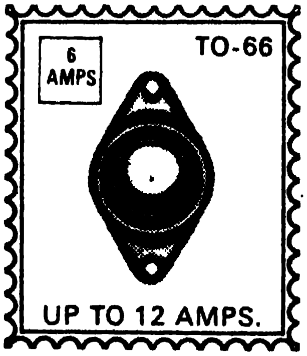

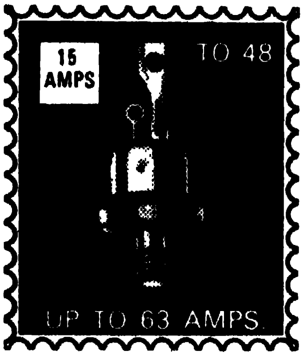

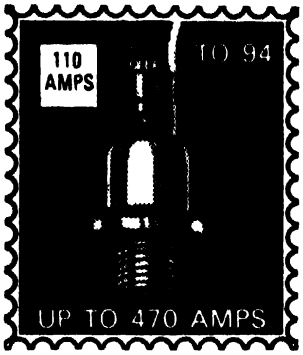

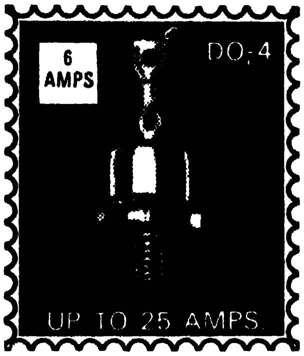

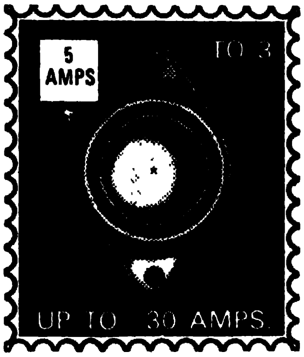

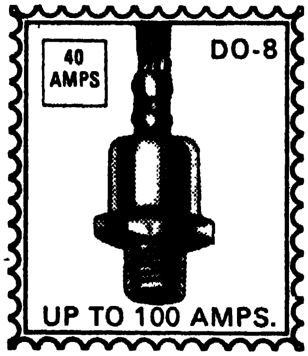

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CIRCUIT IDEAS

A Photoflash Slave for Electronic Flash

This simple and cheap device can be of great help to an amateur as well as a professional photographer. It provides an additional unit for an electronic flash-gun so that unwanted shadows falling on the subject being photographed can be eliminated. The electronic flash units are operated by the shorting of a pair of contacts when the camera's shutter opens. While using electronic flash units with the photoflash slave device, the SCR does this job.

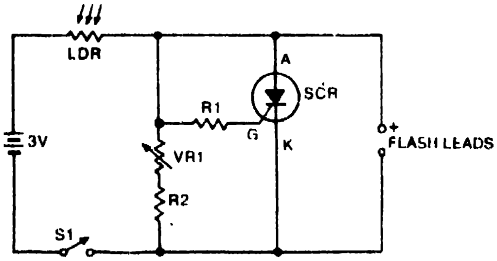


Fig. 1: Circuit for photoflash slave

PART LIST

SCR— 1A, 400PIV silicon controlled rectifier
LDR— EIP 274 (manufactured by Electron India)
R1— 10-ohm, 1/4W, ± 10% tolerance
R2— 100-ohm, 1/4W, ± 10% tolerance
VR1 —1k linear or wirewound potentiometer
S1— Mini SPDT on/off switch
Misc – Penlight cell (with holder), wires, solder, knob, screws, suitable enclosure, flash socket etc

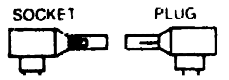


Fig. 2: Connection of coaxial plug & socket

The photoflash slave (Fig. 1) is essentially a light-triggered electronic switch. The light-dependent resistor (LDR) is used as a light sensor.

In dark or in normal lighting conditions, the comparatively high resistance of the order of a few kilohms provided by the LDR keeps the gate circuit of the silicon controlled rectifier (SCR) almost isolated from the 3V battery. When bright light from the main flash-gun falls on the LDR, the intense fall in its resistance virtually connects the gate-cathode circuit of the SCR across the 3V battery. This triggers the SCR, and SCR in turn operates the additional electronic flash. All this happens within a few milliseconds.

Though the time delay between operation of the main flashlight and the slave flashlight is quite small, it is recommended that the shutter speed of the camera be not less than 1/50th of a second (because both flashes should occur while the shutter is open).

Parts placement and layout is not at all critical. The circuit is simple and compact. The total cost of the photoflash slave is around Rs 40.

The coaxial plug attached to the lead coming out of the flash unit should be connected as shown in Fig. 2. The central connection is normally positive. When photoflash slave device is attached to the flash unit, make sure that the voltage at the anode of SCR is positive. This can be checked with an ordinary multimeter at high DC voltage range.

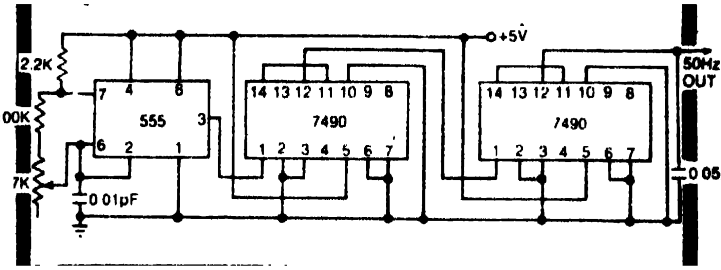
While using this device, make sure that the LDR receives the maximum of light without coming into the actual picture area. A sensitivity control (VR1) has been provided in the photoflash slave device. The sensitivity will be proportional to the resistance provided by this potentiometer.

PRADIP KUMAR SAHU

Portable 50Hz Source

For battery operated digital clocks, such as mobile clocks, a 50Hz source is required. The time accuracy of the clock depends upon the stability and accuracy of this 50Hz source. Although quartz crystals are most reliable, they are expensive. The following circuit can give a reasonably accurate source of 50 Hz at a lower cost.

The circuit consists of a BEL's (Bharat Electronics Ltd's) CA 555 timer operating at 5 kHz. This frequency is divided by 100 by a chain of two counters, each dividing by ten. ICs 7490 are used as divide-by-ten counters. BEL's CA 555 alone can also give 50Hz output, but its output is more stable at 5kHz. The 2.7k preset can be adjusted for exact 50Hz output.



The circuit operates on 5V battery. This supply can be obtained by a regulator IC, such as BEL's CA 723, operating off the vehicle's 12V supply.

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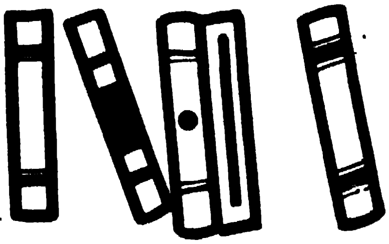

BOOK REVIEWS

Electronics in Uttar Pradesh

Guidelines for Electronics Entrepreneurs published by U.P. Electronics Corporation Ltd, 4 Prag Narain Road, Lucknow 226001; pages 224; price Rs 35

Those entrepreneurs who are desirous of setting up electronics units in Uttar Pradesh—the most populated state of the country—have been provided with all the information that they need in the publication under reference.

The very first chapter entitled "What to make?" sets out the main factors which need to be taken into account while embarking upon a new venture in this sophisticated industry

The second chapter emphasises the importance of sales forecasting and measurement. The real challenge lies not in manufacturing but in marketing—this is the moral of this chapter.

Techno-economic feasibility reports are discussed in the third chapter which highlights the importance of reaching the break-even point at the earliest opportunity.

The fourth chapter is devoted to industrial licensing and procedures. Full knowledge given in this chapter can help an entrepreneur in cutting out wasteful effort.

In order to promote industrial growth in the state, the government has provided a number of incentives, all of which are listed in the fifth chapter.

The selection of the site for the factory, the search for technical knowhow and the procedures regarding the formation of a company are explained in the sixth, seventh and eighth chapters respectively.

And then follow a number of appendices which give details regarding (a) the processes available with NRDC, (b) items with good market potential, (c) proforma of the agreement for claiming subsidy on techno-economic feasibility reports and a host of other features which are extremely useful.

The publication under reference demonstrates that the U.P. Electronics Corporation Ltd has come a long way since it was set up four years ago. It has gained considerable experience in extending assistance to entrepreneurs.

Perhaps it will take a long time and a lot of persuation to attract entrepreneurs to Uttar Pradesh. The strong pulls exerted by the electronics markets in Bombay, Delhi, Bangalore etc make it difficult for entrepreneurs in Uttar Pradesh to get established. The recent attempt to attract electronics entrepreneurs to Ghaziabad (which is so near to Delhi) are at once realistic and full of promise.

Trouble Shooting TV Receivers

by K.K. Banerjee; published by Kwality Book Company, 31 Lenin Sarani, Calcutta 700013; pages 154; soft cover; price Rs 20.

The author possesses adequate academic qualifications and professional experience to pen a book concerning the servicing of TV sets. It has been written for those who aspire to be technicians in this sophisticated field and also wish to earn a handsome fee every month. It is the author's claim that a TV engineer in a metropolitan city can hope to have a gross income of Rs 50,000 a year.

Starting with the working of a TV set, the book under reference describes the television system in our country, circuit of hybrid TV, circuit of solidstate TV, TV testing procedure etc and goes on to explain controls and adjustments of hybrid TV receiver and solidstate TV receiver and various TV accessories. Nearly 50 pages are devoted to exhaustive hints regarding the technique of servicing TV sets.

A comprehensive and useful book, it lacks only in two respects. Proofreading is poor and language at places needs to be polished. Let us hope the author will institute these improvements in the next edition.

Now Available: Sets of 1978 issues

Complete sets of the 12 issues for the year 1978, including the Annual Number 1979 of 300 pages, are now available in a limited number.

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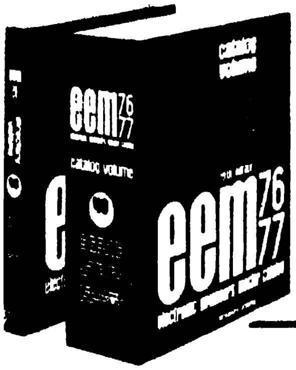
New EFY Readers May Please Note

There appears to be some confusion among the new readers of Electronics For You regarding the December 1978 and Annual Number 1979 issues.

They are requested to note that these two issues are one and the same. There is no separate issue for the month of December 1978. Copies of the Annual Number 1979, a bumper issue of 300 pages, were mailed to the subscribers on January 13, 1979.

—Managing Editor



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PRODUCT PROFILES

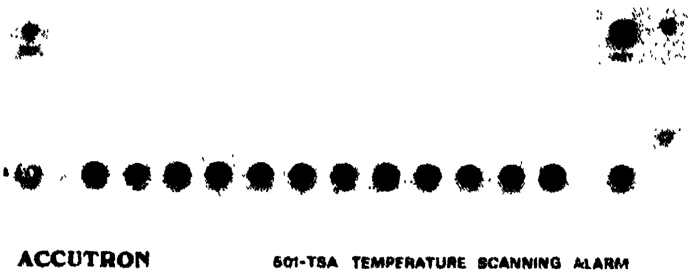
THROAT MICROPHONE

'Gulmarg' throat microphone, introduced perhaps for the first time in India by Electronics Limited, eliminates background noise and can be used in high ambient noise conditions, e.g. in tanks and aircrafts, where normal microphones cannot be used.

Its ceramic bimorph transducer, housed in ABS plastic, is hermetically sealed and is unaffected by water, smoke, dust, humidity, strong winds, pressure or magnetic field, according to the company.

The microphone can accept a load impedance of 250k ohms (usable down to 47k ohms). For low impedance loads of 100 ohms and above, an optional impedance converting pre-amplifier is available. Its output is 5mV (± 3dB) for normal speech at rated load impedance.

Contact : Electronics Ltd, 26 N.I.T. Faridabad, Haryana 121001



TEMPERATURE SCANNING ALARM

Thermadyne has introduced 'Accutron' temperature scanning alarms which can monitor 6, 12 or multiples of 12 temperature points. It has a facility for alarm and trip: at 90% of the set point, it gives an audio-visual alarm and at set point the reply energises to trip the system. In special applications, against request, these temperature scanning alarms can be converted into on-off controllers.

The alarms are available in the two standard versions—one type has a single set point arrangement for all the points with single tripping relays for motor winding, temperature monitoring and tripping applications, and the other has individual tripping relays for each point for process industry applications. Optional facilities include external clock inputs and BCD outputs for printer connections.

Contact : Marketing Division, Thermadyne Private Ltd, C-120 Naraina Industrial Area, New Delhi 110028

LOGIC PROBE & PULSER

Networks has introduced perhaps for the first time in India, a universal logic probe and pulser pair which can be used for all DTL, TTL and CMOS ICs. It operates from 5 to 15 volts in CMOS or TTL applications.

The probe and pulser are housed in a pen-shaped moulded body with 1.7 cm dia and only 43 gms weight. Some important features of the probe are multi-family logic indications, pulse stretching for narrow pulses as low as 25 nanoseconds, 1 megohm input impedance, 20 μA input current, maximum pulse repetition frequency of 40 MHz etc , with overload protection of 70V DC at input. The pulser automatically injects a proper polarity pulse.

Contact:Networks Private Limited, 2 & 4 Uptron Estate, Panki, Kanpur.

DIGITAL MULTIMETER

The Vaiseshika 7706 digital multimeter has a 3½-digit LED display. It can measure AC/DC voltage, AC/DC current and resistance with a basic accuracy of 0.1%.

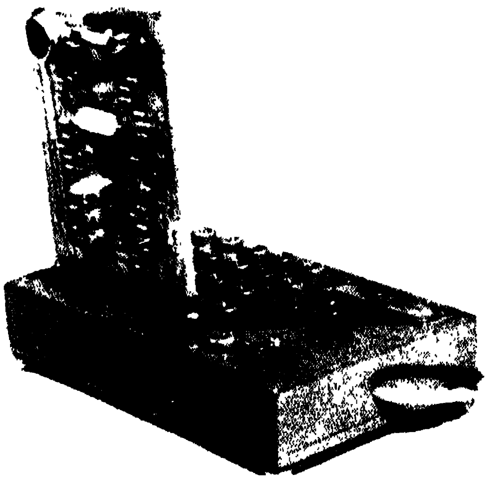
The instrument has provision for BCD output. It can measure temperature from 0°C to 100°C with the help of a temperature indication module and BCD connectors which can be provided with the instrument as accessories.

Contact : Vaiseshika Electron Devices, Post Box 57, Ambala Cantt 133001.

PCB TESTING BOARDS

These boards are most suitable for testing of various electronic printed circuits, for checking defective cards or after final component assembly. These platforms consist of PCB connector/s, terminal sockets, built-in DC power supply and pilot lamp to indicate mains. Each socket is connected internally to the respective pin of the connector. The two terminals of DC source are brought on the board.

Units with positive/ground/ negative DC and variable DC voltage can be fabricated on request. All these components are of standard makes mounted on decent sheet-metal box which is light in weight and compact in size. Unit works on 230V AC mains supply.

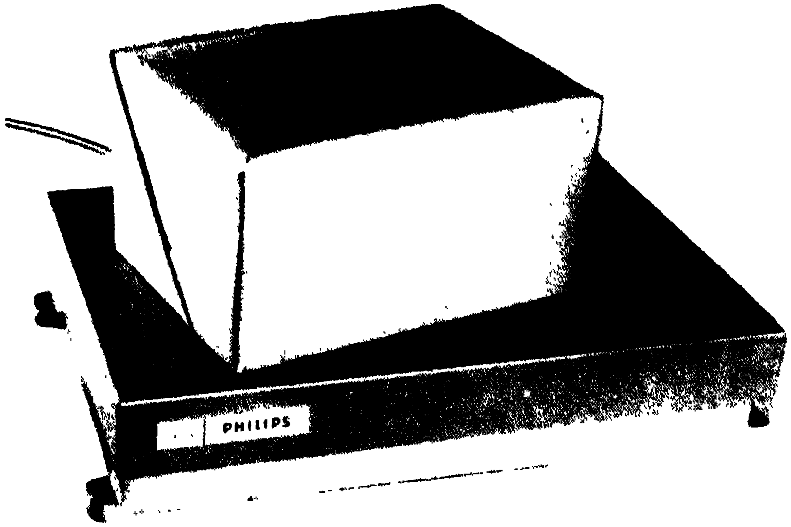


Complete fabrication, designing and assembling of electronic printed circuit boards is also undertaken.

Contact: Veego Instruments Corporation, 67-68 Parleshwar Society, Vile-Parle (East), Bombay 400057.

ELECTRONIC WEIGHING PLATFORM

An electronic weighing platform which measures only 30 x 25 cm in its smallest version, is announced by Philips GmbH, Werk fur Messtechnik, to meet the growing demands for a smaller type of industrial scale covering such applications as check weighing, container filling, batching, belt weighing and belt feeding.



Called the PR 6160 series, these scales are available in six weighing capacities ranging from 20 Kg to 500 Kg. Scales with capacities from 100 Kg upwards are supplied with a larger (60 x 60) platform.

Based on the well proven strain gauge principle, the scales are fully electronic in operation and thus have no moving parts to wear and cause fall off in accuracy.

A fast response time, excellent "off centre" loading characteristics (<0.02%) and a standardised electronic output (2mV/Volt) gives the possibility for full integration within modern process control.

Contact: S & I Department, Philips India Ltd, Shivsagar Estate, Block 'A', Dr Annie Besant Road, Worli, Bombay 400018.

REGULATED SUPPLY

Farm's FTVS-30/1 supplies regulated DC voltage from 0 to 30V

(continuously variable in 3 ranges), and a maximum load current of one ampere. It is fully solidstate in design and short-circuit protected. Its line regulation is 0.01% for ±10% variation in supply, and load regulation is 0.1% maximum from no load to full load.

Contact: Farm Electronics, 7 Dube Colony, Indore 452004.

ELECTRONIC TIMER

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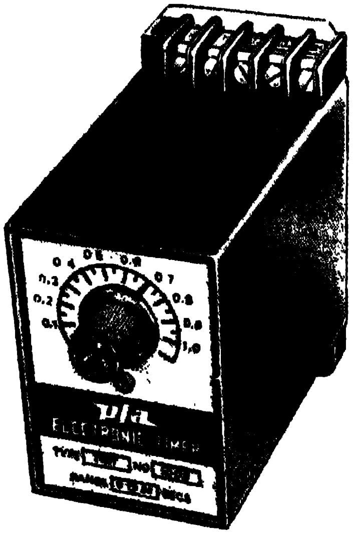
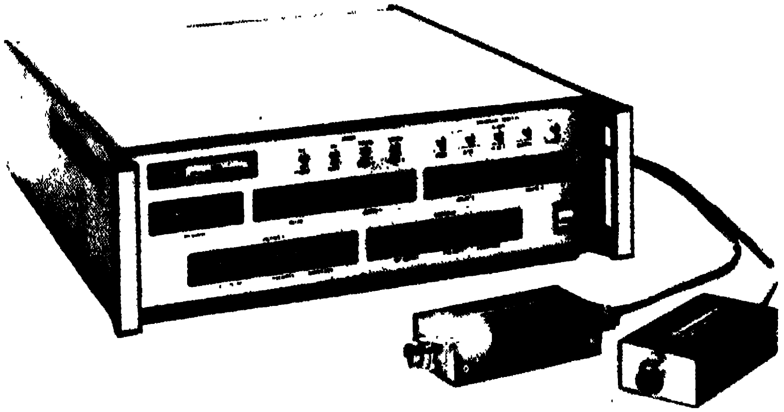


in various voltages and different timing ranges from 0.5 to 300 seconds, with reset time as fast as 100 milliseconds. The repeat accuracy is better than ±2%. On /off delay timers are available with two changeover contacts rated for 6A load at 230V AC.

Contact: Starch & Allied Industries, Electronic Division, Thakore Estate, Kurla Kirol Road, Vidyavihar West, Bombay 400086.



PULSE GENERATORS

E-H International Inc., USA, announces models 1505 and 1506, two programmable pulse generators with enhanced output capabilities. Designed for automatic test system applications requiring subnanosecond rise time, the 1505 and the 1506 feature subnanosecond ECL pulse drivers (500pS) and 3nS timing.

Based on the proven output design of the EH 1503, the single-channel 1505 and the dual-channel 1506 can drive the fastest digital logic circuits. The output for each unit is located at the end of an umbilical cord, which brings the fast pulse directly to the fixture that holds a device under test.

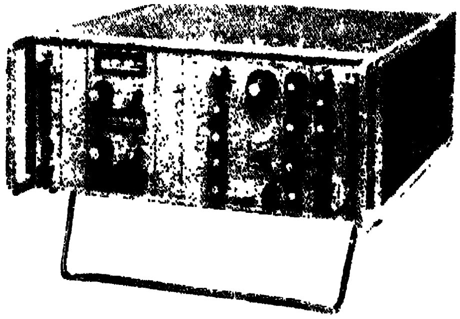
The 1505 and 1506 offer output amplitudes variable to ± 2.5 volts into 50 ohms with baseline offset variable to ± 1 volt. The 1506 has two independent output channels utilizing a common programmable frequency. Output amplitude, width, delay and offset are independently adjustable for each channel.

Contact: Trans Marketing Private Limited, Sterling Centre, 16/2 Dr Annie Besant Road, Bombay 400018.

SWEEP GENERATOR

Gould Instruments Division has entered the sweep-generator market with its Advance SW 100, which can cover 1 MHz to 1600 MHz in a single, flat sweep. Other key features of the instrument include a comprehensive automatic marker system for precise frequency determination and an output level unit that can be varied in 0.01 dB steps.

The SW100 incorporates electronic switching between the three basic ranges (1-500MHz, 450-1000MHz and 950-1600MHz) to give the effect of a single sweep. Deviation from flatness is ±0.25dB using a power meter, or ± 0.35dB measured on a full-wave detector.



The three operating modes of the SW100 are: start/stop or F1/F2 mode, in which a sweep occurs from one set frequency to another; FC/Δ f mode, in which a centre frequency is set in the middle of a spectrum of interest with one control and a deviation about the centre frequency is set with another control, and signal generator mode, in which the sweep drive is switched off and the sweeper is used as a straight signal generator.

Contact: C.H. Krishnan & Associates, C-24 New Delhi South Extension Part II, New Delhi 110049.

IC PATCHBOARDS

Racal's IC patchboards are designed to save time and money.

This solderless breadboarding system may be used with TTL, CMOS, linear and other integrated circuits for teaching logic or development work and circuit evaluation.

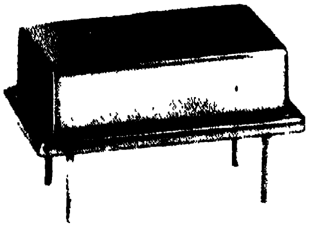
The patchboard PB0001 can simulate a circuit with 15 ICs. It has a + 5V battery power supply. Mains-operated power supply can replace battery as an option. Banana terminals are provided for ground, + 5V and two external power supplies, if needed.

Contact: Racal Electronics, 2356 Dholani Khadki, Raipur, Ahmedabad 380001.

DIP OSCILLATOR

Motorola Inc., (Communications Systems Div.), USA introduces a new, low-cost, crystal-controlled, thick-film, DIP oscillator offered in three frequencies — 16.000 MHz, 18.432 MHz and 19.6608 MHz. These frequencies in 'Loco II' have been carefully chosen as standard master clock frequencies because they divide down readily to produce baud rates and MPU frequencies.

These are available against actual users' import licence or OGL.



Contact: Echbee Corporation, Kamer Building, 5th Floor, 38 Cawasji Patel Street, Bombay 400001.

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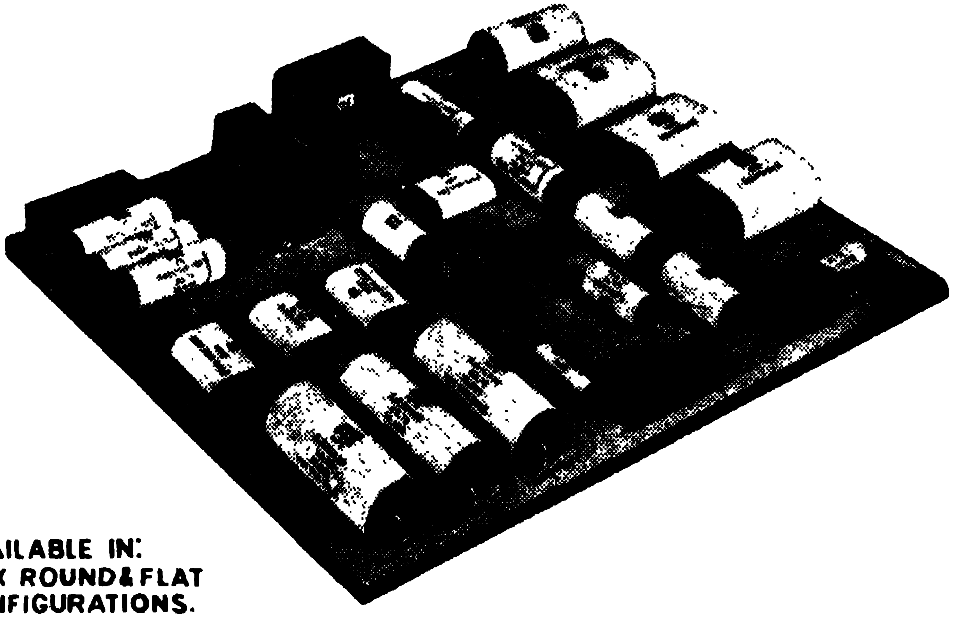

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COMPANY PROFILES

Meltron Forges Ahead

Maharashtra Electronics Corporation Ltd (Meltron)—a state-owned enterprise—has planned to undertake four projects. They will concern the manufacture of (a) silicon power devices for communication equipment such as transreceivers, (b) rural telephones, (c) facsimile for electronics telephone auxiliary boxes and (d) minicomputers.

Meltron has also set up a central marketing division for providing support to small-scale units in marketing their products.

For the silicon power devices project, which will have an installed capacity of six million semiconductors, a new company—Meltron Semiconductors Ltd—is being set up. Its factory will be situated at Ambad industrial area of Nasik. The cost of the project is estimated at Rs 48.5 million, including foreign exchange components of the value of Rs 15.2 million. The financial institutions have agreed to provide the necessary financial support. Technical knowhow for the project has been obtained from Thomson-CSF (France).

The unit at Ambad will be the first of its kind in our country; it will produce power conductors with plastic packing rather than with the conventional metal packing. These power devices will be supplied to the electronic equipment industry at competitive rates. The range of products will include power transistors, thyristors and triacs, zeners and rectifiers. These power control devices will save a large amount of electrical power being lost in conventional type of existing power control systems.

Production is expected to start in early 1980 and will attain full licensed capacity within three years. The entire plant and machinery will be supplied by Thomson-CSF. It has given a 60 per cent buy-back guarantee of the company's production.

The project for the communications equipment has been earmarked for the public sector—for which technical collaboration will be provided by Japan Radio Corporation. This enterprise will be a subsidiary of Meltron. It will manufacture transreceivers, rural telephones without telephone exchanges and facsimile for transmitting charts, maps etc.

Meltron is expecting to get a letter of intent soon for manufacturing electronics telephone auxiliary boxes (PBX). At present, Indian Telephone Industries is the only manufacturer of this equipment in our country. To some extent, imports are also permitted. While technical cooperation will be provided by Thomson-CSF (France), the project is reserved for the public sector.

Plans are afoot for the minicomputers project. Meltron will release additional details about it at a later date.

Debikay Electronics Makes a Debut in Thyristor Controls

CGEE Alsthom, a member of Compagnie Generale D'electricite of France and Debikay Electronics entered into a collaboration about five years ago for the manufacture of thyristor controls. The agreement became operational last year only, but Debikay Electronics has already supplied thyristor controls to two of the biggest paper units to be set up in this country in recent years. The thyristor controls supplied to these units were entirely indigenous and employed the latest hardware and software.

Debikay today is a leader among the manufacturers of thyristor controls for the paper industry. Since the government is keen to expand the capacity of paper units and has already issued a number of letters of intent and licences, the demand for thyristor controls has picked up. Debikay is also expecting to procure orders from the metallurgical sector, especially steel mills.

Debikay has developed expertise and capacity in turnkey electrical contracting and manufacture of electrical control panels for paper and other industries.

CGEE Alsthom and Debikay Electronics have decided to bid jointly for industrial and utility projects in third countries. This speaks volumes of the confidence that the French collaborators have developed in the Indian partner. The two have quoted jointly for some large tenders in South-east Asian countries.

The Asian market in particular is not new to Debikay Electronics. It has already supplied equipment in such countries as Indonesia, Burma and Hong Kong.

Also, in association with CGEE Alsthom, Debikay Electronics is making a bid to introduce the up-to-date power electronics and automation technology for the power sector in this country where substantial expansion is expected to take place in the next five years.

ECIL: Production Moving Up

An exhibition of communication equipment was organised in New Delhi in the first week of March by Electronics Corporation of India Ltd. (ECIL). At the inauguration function of the exhibition, Mr S. R Vijayakar, managing director of ECIL, said that the enterprise would raise its output to Rs 300 million during the current year.

Mr Vijayakar said that the sophisticated electronic items manufactured by ECIL compared with similar goods produced in other countries in quality and reliability. He however conceded that in certain lines of electronics manufacture, our country was lagging behind most of the developed countries. While in industrially developed countries new electronic equipment and systems were being developed or existing ones were being constantly improved, in our country, because of both financial constraints and paucity of highly-skilled personnel, such updating could be done only once in two years.

In his presidential address, Air Marshal J. Zaheed, emphasised the need for research and development for bridging the technological gap between early starters and late starters in the field of electronics.

Mr L. K. Advani, the central minister for information and broadcasting, who inaugurated the exhibition, urged the electronics industry to realise that quality is the essence in its line of manufacture.

International Data Management

The former International Business Machines (IBM) personnel established the International Data Management (IDM), nine months ago after the exit of the American giant from the Indian market.

IDM has thus filled the technological gap created by the departure of IBM. What is more, IDM has entered into collaborative arrangements with two American companies for the supply of latest computer systems of medium and large sizes.

INTEL International has agreed to collaborate in the installation of large-size computers. Prime Computers Inc. has consented to supply medium-range computers.

And now NELCO—a Tata unit—has entrusted the marketing of NELCO 3000 business system to IDM.

According to Mr D. J. Shah, managing director of IDM, the company is now in a position to meet the requirements of computer users of all sizes.

In particular, IDM has entered into arrangements with Prime Computers Inc. for the right solution to various IBM 1401 computer users as the product life of this computer is coming to an end.

It may be stated that in 1978, our country imported computers of various sizes valued at Rs 160 million.

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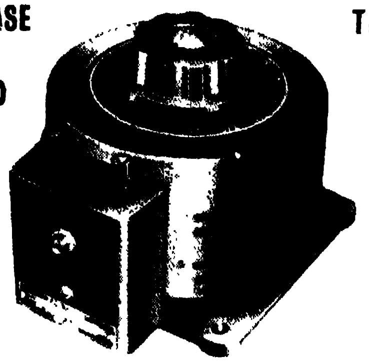

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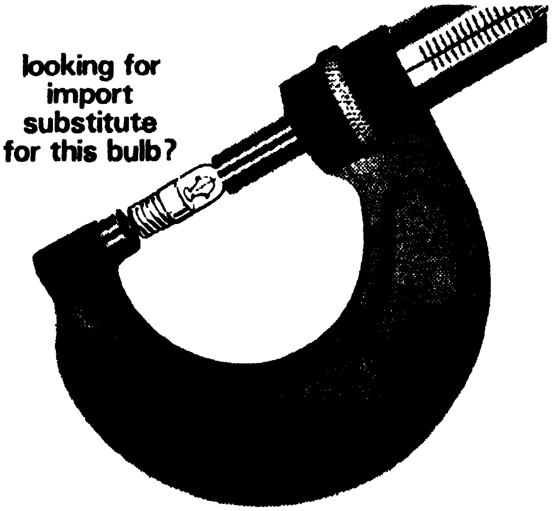

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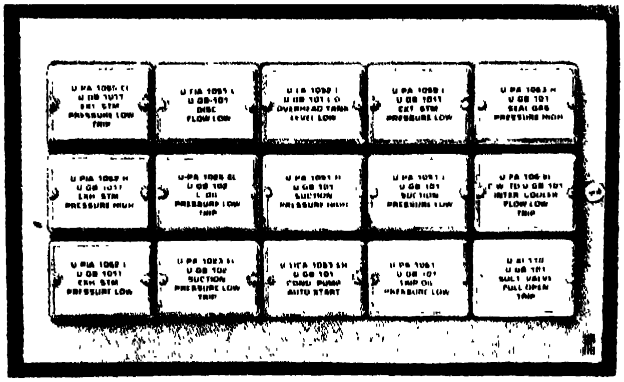

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FACTS & FIGURES

The Changes Proposed In Excise Duties In the Budget for 1979-80

Commodity	*Rate of duty (Basic)*		*Estimated net effect in one full year*
	Existing	*Proposed*	
(1)	(2)	(3)	(4)
			(Rs. million)
Wireless receiving sets, etc			56.0
(1) TV sets	20%	30%	
(2) Radio (including transistor sets)	35%	40%	
(3) Radiograms	35%	40%	
(4) Others	35%	40%	
Effective rates			
A. TV sets			
(a) of screen size of 36 cms or less			
(i) single channel set of a value not exceeding Rs 1400 per set	5%	15%	
(ii) multi-channel set of a value not exceeding Rs 1550 per set	5%	15%	
(iii) others	20%	30%	
(b) of screen size exceeding 36 cms			
(i) single channel set of a value not exceeding Rs 1600 per set	5%	15%	
(ii) multi-channel set of a value not exceeding Rs 1750 per set	5%	15%	
(iii) others	20%	30%	
(c) Combination of TV Sets and Radios	25%	30%	
B. Radios			
(a) sets of one or two bands	15%	NC	
(b) sets of three bands and of a value not exceeding Rs 250 per set	25%	NC	
(c) sets of three bands and of a value exceeding Rs 250 per set, and sets of four bands	30%	35%	
(d) sets of five bands or more	35%	40%	

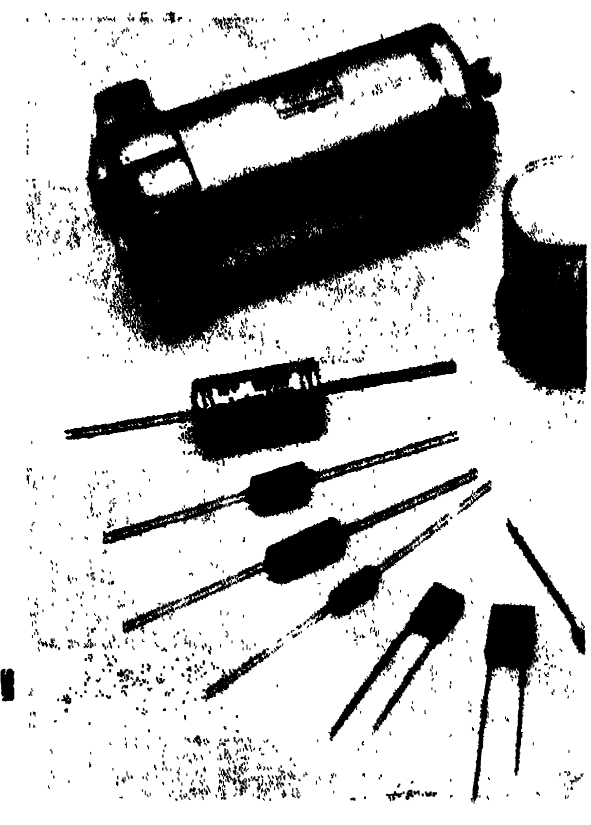
(The above rates are being reduced by 15% ad valorem in favour of radio sets manufactured in a small industrial unit subject to certain conditions)

Radios including transistor sets of value not exceeding Rs 165 per set will continue to be exempted if the sets are manufactured in a small industrial unit fulfilling certain specified conditions.

Commodity	*Existing*	*Proposed*	*Estimated net effect in one full year*
Office machines etc	15%	20%	23.1
Effective rates			
(a) Electronic calculating machines (other than slide-rule calculating machines) of a value not exceeding Rs 175 each	5%	10%	
(b) Electronic slide-rule calculating machines of a value not exceeding Rs 450 each	5%	10%	
Computers	15%	25%	2.4
Musical systems			1.0
(1) Stereo or hi-fi amplifiers	35%	40%	
(2) Speakers and speaker systems, etc.	35%	40%	

(1)	(2)	(3)	(4)
Concessional rate of 20% for stereo or hi-fi systems manufactured in small units fulfilling certain specified conditions is being raised to 25%.			
Gramophones and parts			0.3
(i) Gramophones, record players, record playing decks, or record-changer decks.	20%	25%	
Effective rates			
(a) L.P. and E.P. gramophone records	10%	15%	
Concessional rate of 10% for gramophones, record players etc falling under sub-item (i) above, manufactured in small-scale units, subject to certain conditions, is being provided.			
Tape recorders	30%	40%	2.5
Effective rates			
Tape recorders etc, including combination sets with transistor radios—			
(a) of value not exceeding Rs 500 each	25%	NC	
(b) of value exceeding Rs 500 each	30%	40%	
Note: The above rates shall be reduced by 15% ad valorem if the tape recorders are manufactured in small industrial unit fulfilling certain specified conditions.			
Permanent magnets	50%	NC	1.8
Effective rates	25%	30%	

NC stands for 'No Change.'



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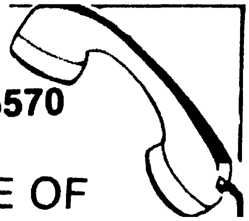

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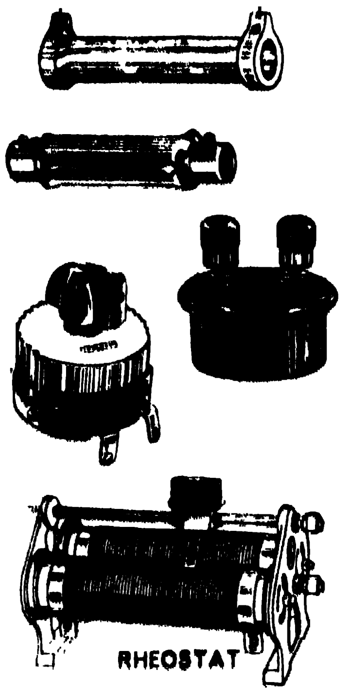

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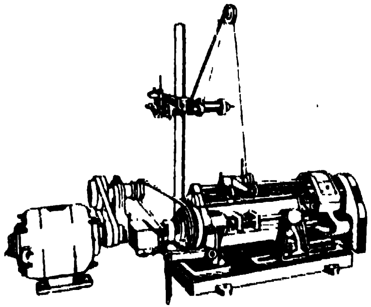

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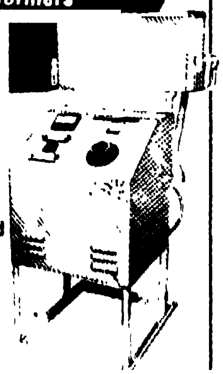

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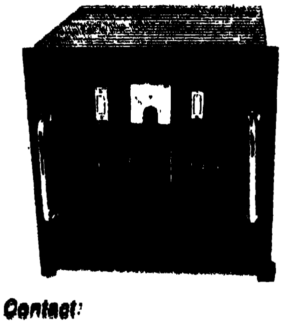

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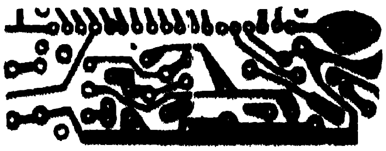

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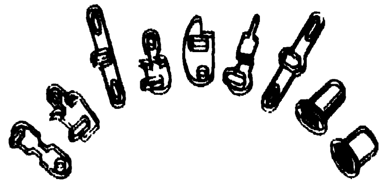

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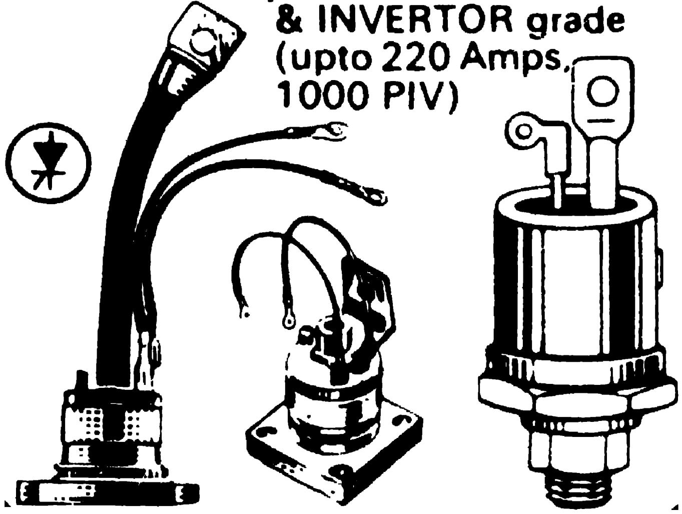

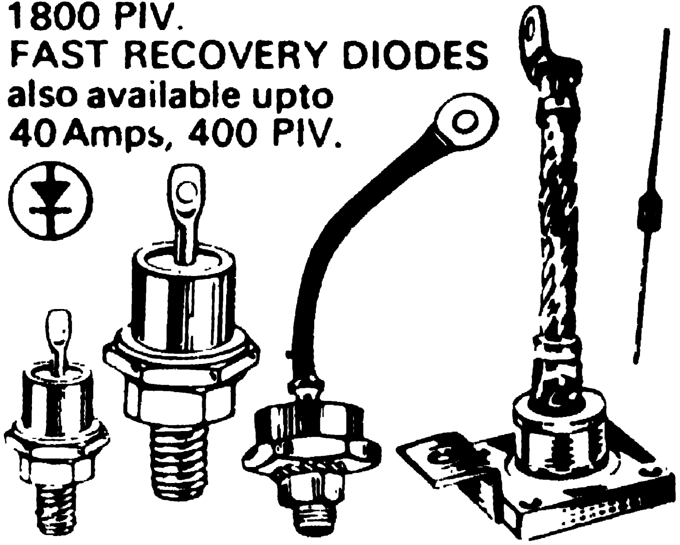

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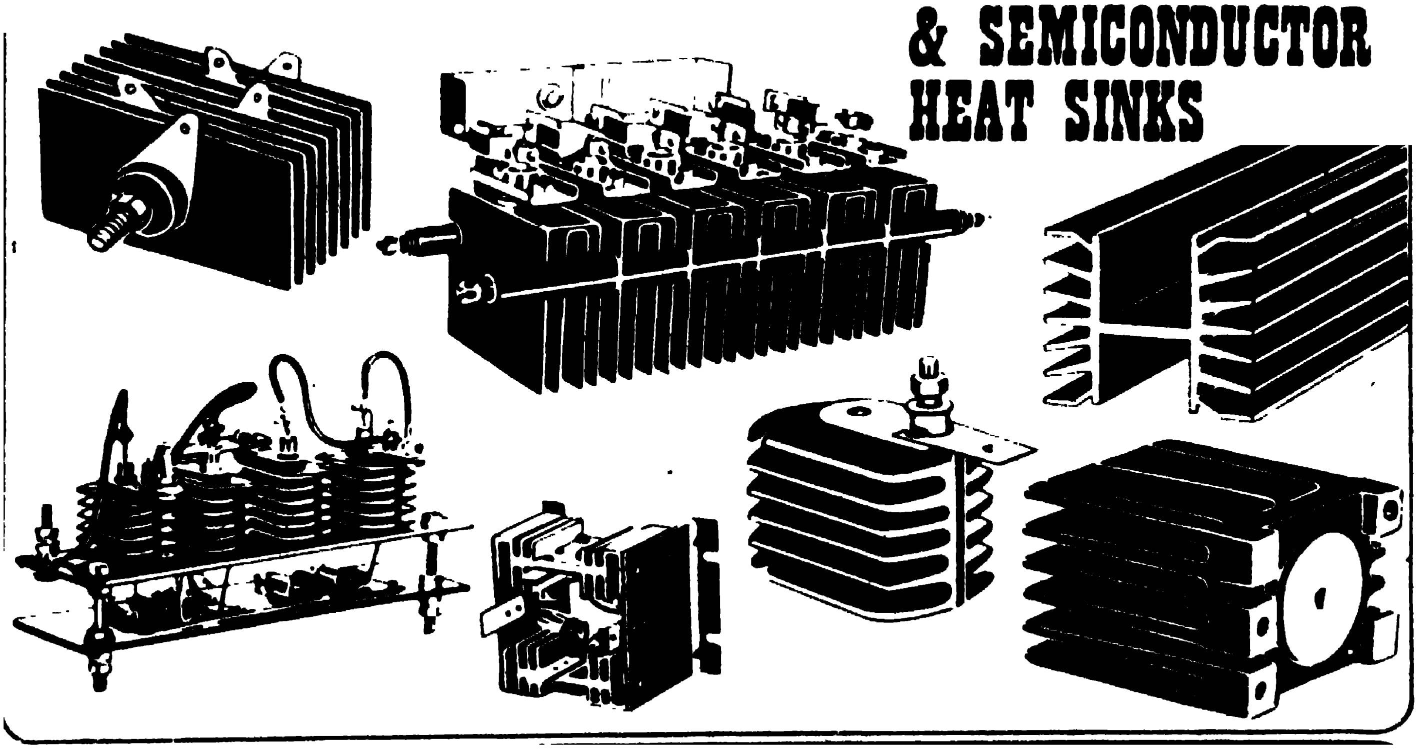

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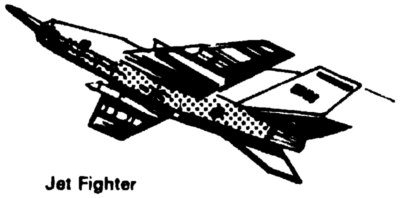
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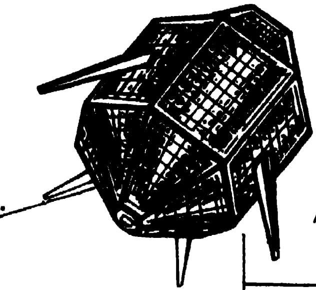
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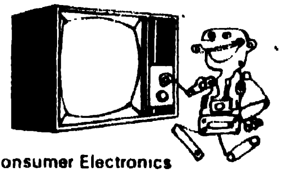
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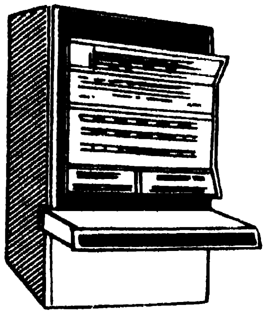
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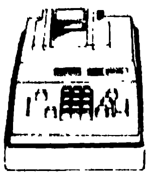
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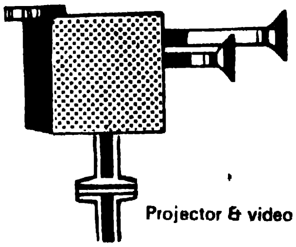
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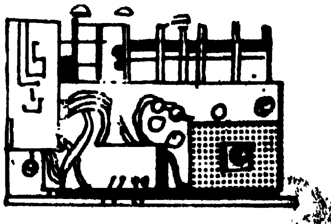

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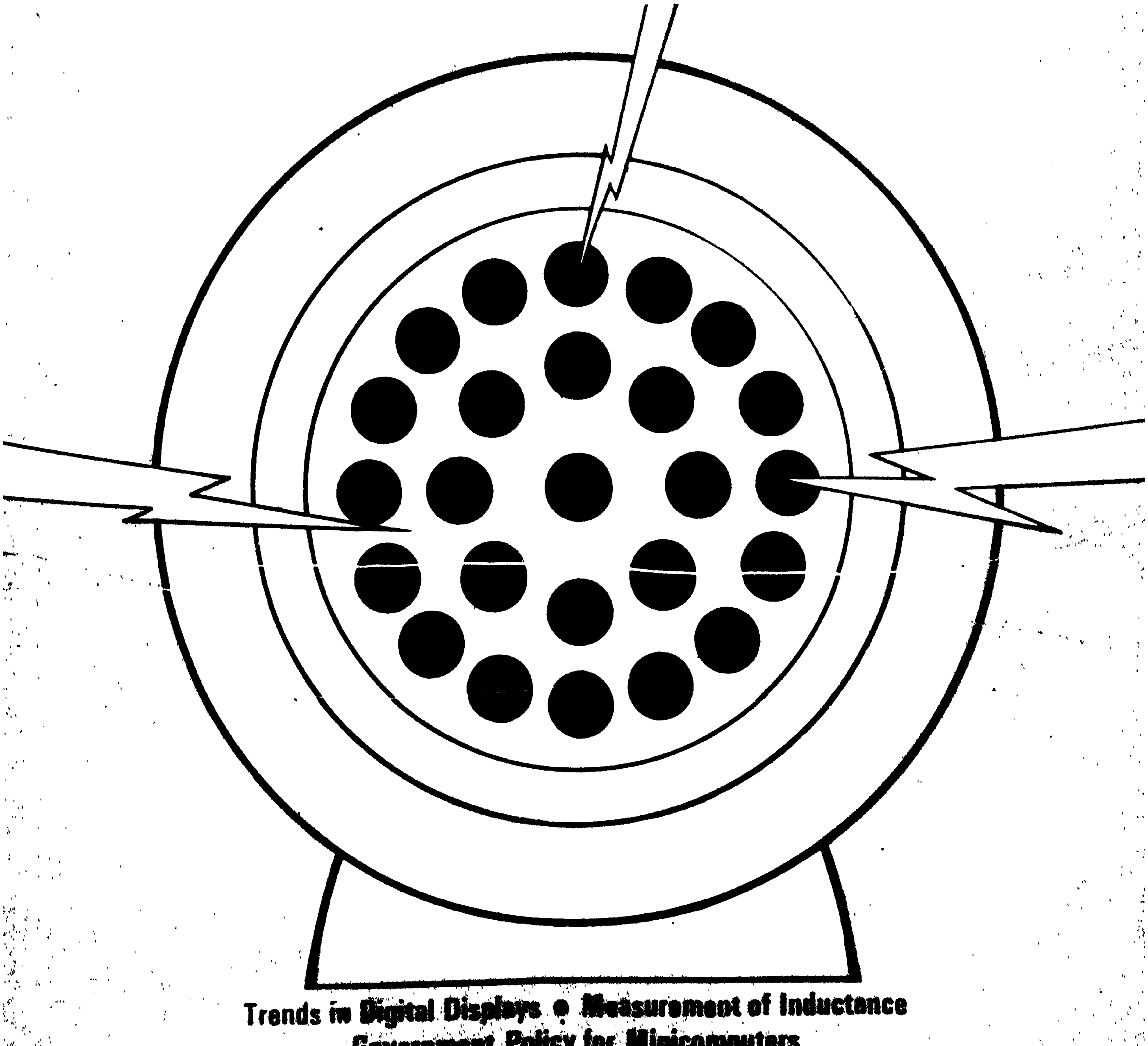

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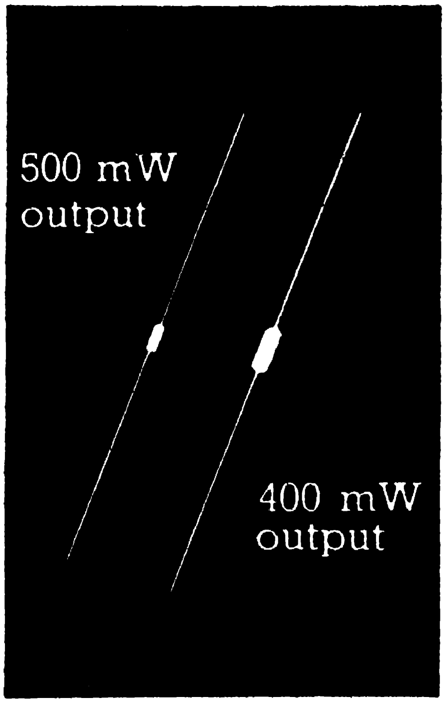

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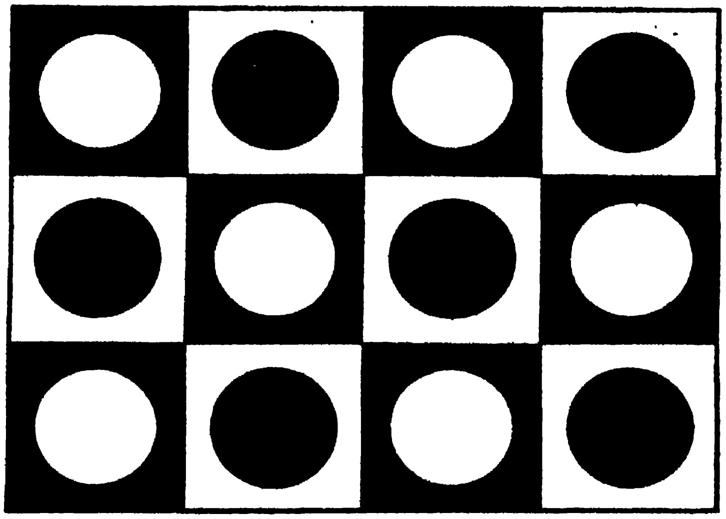

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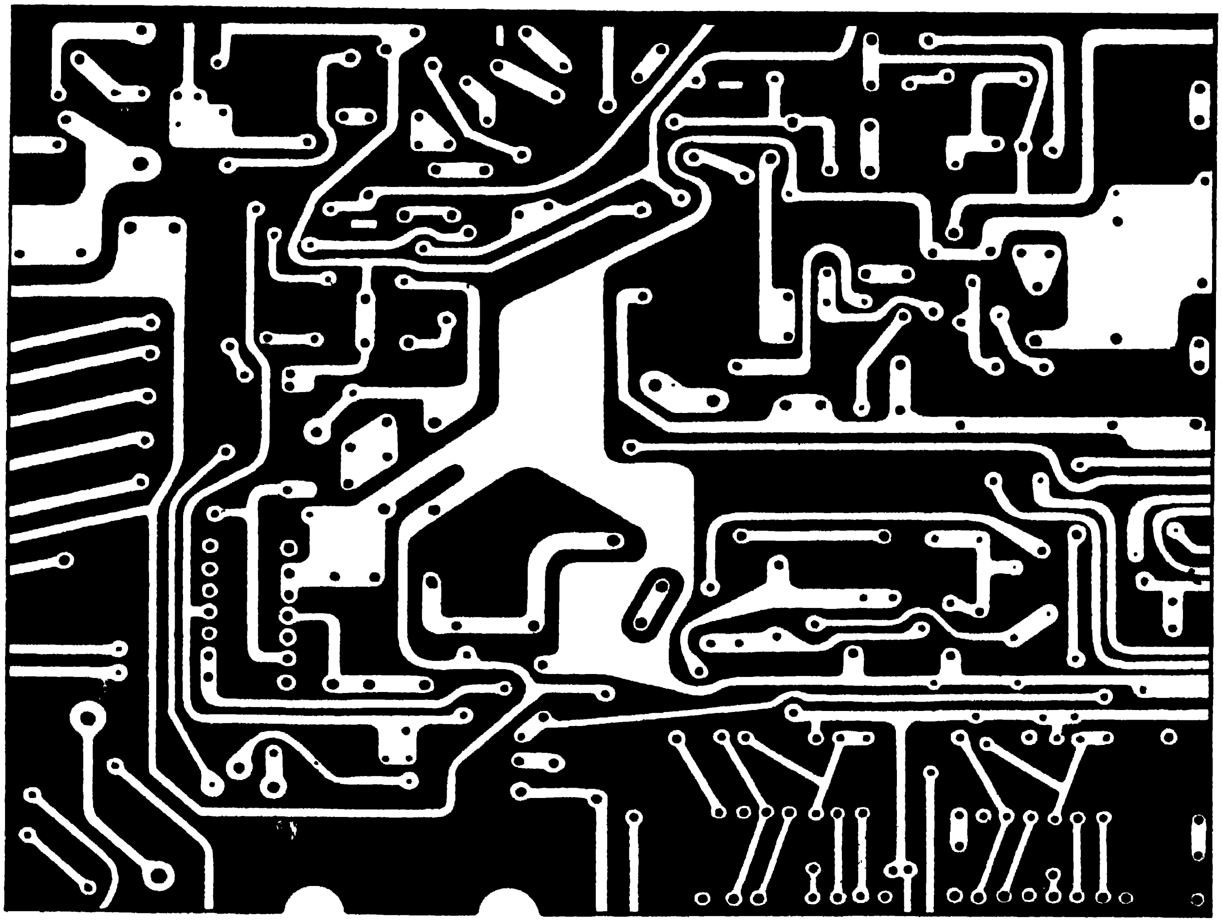

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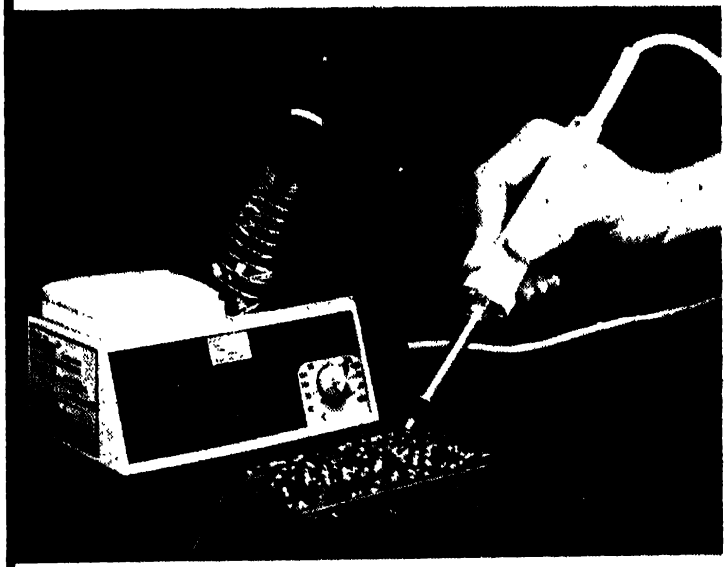

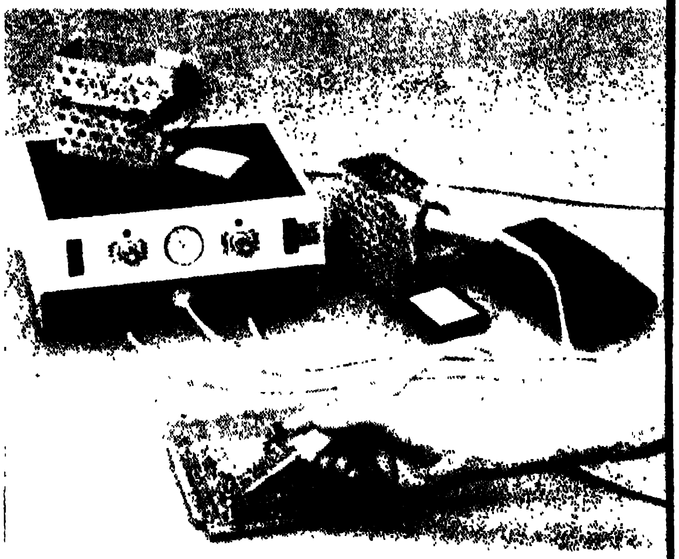

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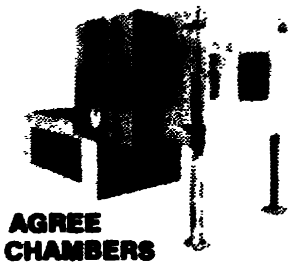

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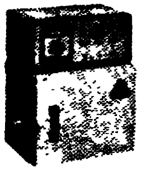

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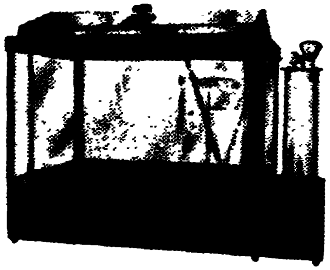

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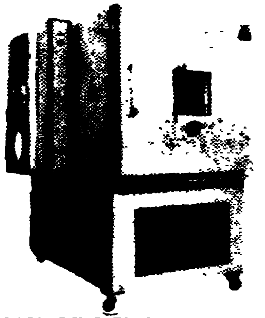

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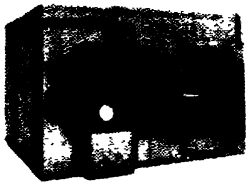

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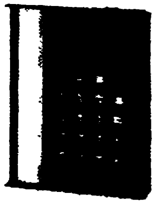

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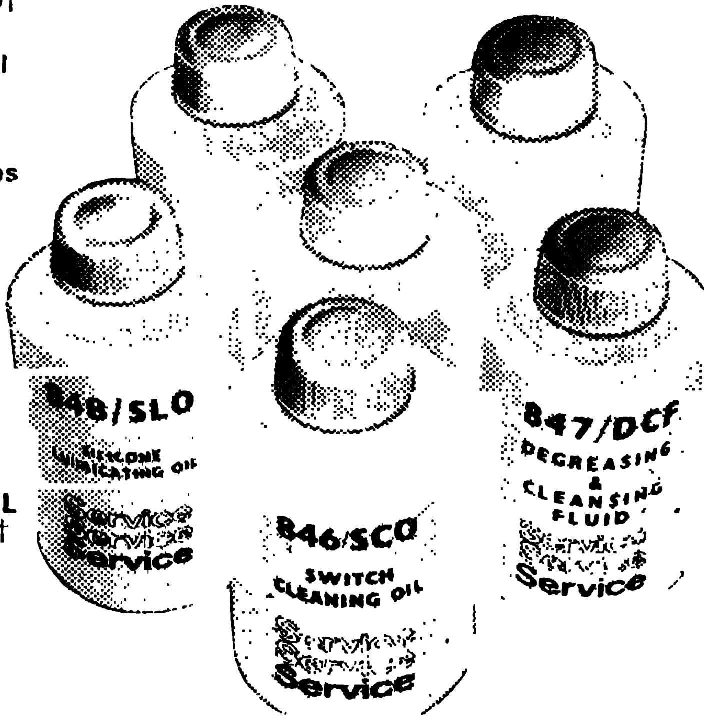

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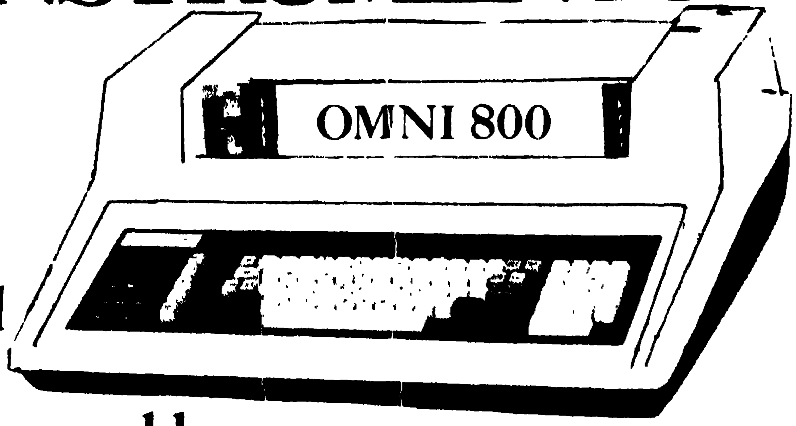

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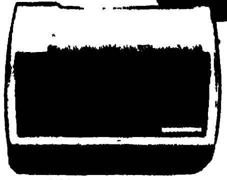

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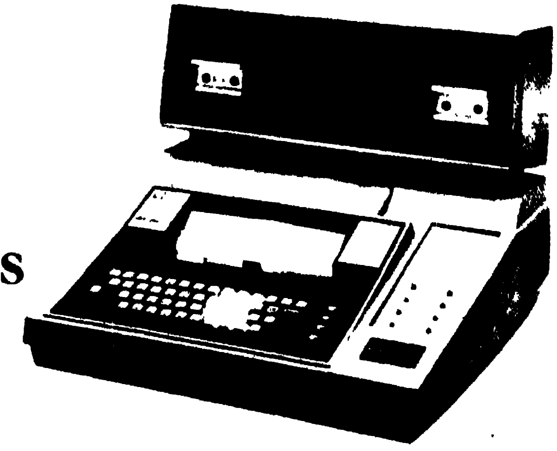

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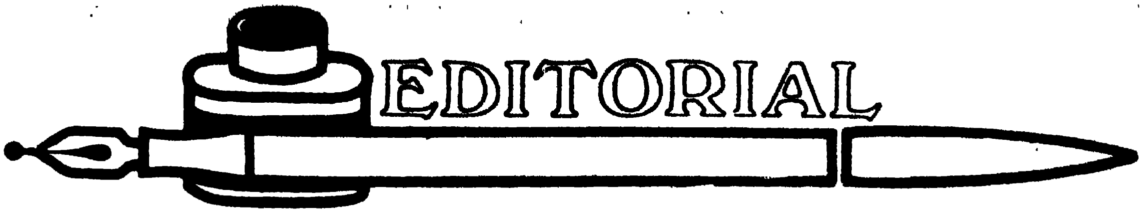


EDITORIAL

COMPUTERS: BLOWING HOT AND COLD

Speaking recently at a group discussion organised by Delhi Study Group, Prof. Madhu Dandavate, the central minister for railways, said that to root out corruption at the reservation level, the railways were planning to introduce computer system.

After the installation of the computer system, passengers at each station would learn about the reservation vacancies directly through electronic flashes at the platforms without having to contact any railway official.

Prof. Dandavate was confident that such a step would eliminate corruption to a considerable extent.

ELECTRONICS FOR YOU agrees with the minister that the installation of the computer system, at least at the major railway stations, will end the misery of thousands of railway passengers who suffer indignities at the hands of railway officials besides being made to pay hush-hush money below the counter. This recommendation of the railway minister needs to be made operative without loss of any time.

While Prof. Dandavate's suggestion will gladden the hearts of all those who have the good of the country at heart, a newspaper report appearing in a recent issue of the *Economic Times* will surely make them sad.

According to this report, the deputy prime minister and finance minister, Mr Charan Singh, has rejected a proposal to instal a computer system for the income-tax department in Delhi.

It is no secret that the pending cases with the income-tax department are mounting every year and the filing system is in a mess. Computerisation of its operations would certainly bring some order in its affairs.

It may be stated that the proposal to instal the computer system has gone through the usual red tape. The Central Board of Direct Taxes had got the proposal cleared by the Department of Electronics, and it has had prolonged consultations with Tata Consultancy Services, Bombay.

Mr Charan Singh's opposition is due to the protests of the employees who have demanded that the computer should not be installed as it would deprive them of employment and possibly cause retrenchment.

It is indeed odd that in the computer age of today, workers are opposed to the installation of computers even when they are given the assurance that there would be no retrenchment after the installation of a computer.

The Board of Direct Taxes is convinced that the computer facility would streamline the work of maintaining permanent account numbers of assessees both in personal and corporate sectors.

Mr Charan Singh had assured in his budget speech that he would take all possible measures in order to speed up the recovery of taxes. Why is he keen to take a step which may not allow him to keep his word in this regard?

Also, who is the official spokesman on policy regarding the installation of computers? This blowing hot and cold by Janata central ministers is adding to the confusion on a matter of policy vital to the economy of the country.

At the recent annual session of the Federation of Indian Chambers of Commerce and Industry, Mr G. D. Birla had referred to the contradictory statements made by central ministers on matters of great importance to the nation. He ascribed the prevailing confusion in the country to the contradictory statements being made by ministers. He rightly stressed that all national policies, whether relating to licensing or any other field, should be production-oriented.

It may be recalled that a special committee on automation under the chairmanship of Prof. V. M. Dandekar had examined this question in depth and had said that "our approach to the problem of the use of computers is positive; we do recognise certain legitimate uses of computers in education, science, research, statistics, defence as also in commercial and industrial establishments."

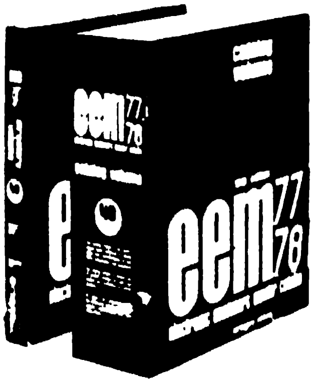
However, the Dandekar Committee had also stated that "In case, no agreement is reached between the management and the workers, the matter should be referred to a bipartite machinery at the national level, comprising representatives of the employers and trade unions. The recommendations, if unanimous, will be binding. In cases where there is no unanimity, the matter will return to the establishment level."

While the Congress government had turned down this recommendation of the Dandekar committee in 1972, Mr Charan Singh is likely to hug it. And so long as he presides over the fate of the Ministry of Finance, the proposals for installing computers in the public sector are likely to be turned down. The pace of installation of new computers is bound to be slowed down, resulting in retardation in the expansion of the economy.

Once again, the Department of Electronics (DOE) and the Electronics Commission will have to face a stonewall in the Ministry of Finance. All the good projects approved by the DOE will get buried in the Ministry of Finance.

eem

Electronic Engineers Master–



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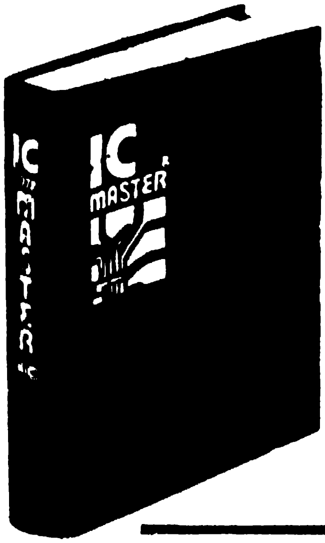

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WHAT'S NEW

In India ...

TV Arrives in Jullundur

On April 13, this year, a TV centre began functioning at Jullundur.

The centre, which is presently functioning with a 1kW transmitter, has a range of 25 km.

A 10kW transmitter is expected to be installed at the centre in another six months. With that its range will go up to 80 km, covering an area of 14,000 sq. km.

More to be Spent on Rural Communications

The union communications minister, Mr Brijlal Verma, told newsmen recently that Rs 8280 million (40 per cent of the total communication plan) have been allocated under the sixth plan for the development of rural communications.

The Indian Telephone Industries (ITI) will be expanded and assisted with foreign collaborations to fulfil this task.

ITI's expansion programme, involving an expenditure of Rs 840 million, will include: (i) setting up of three new factories, one for manufacture of transmission equipment and two for manufacture of electromechanical switching equipment; (ii) expansion of the existing units at Naini, Rai Bareilly, Palghat, Srinagar and Bangalore; (iii) modernisation of manufacturing facilities at Bangalore and Naini; (iv) expenditure of over Rs 320 million on R&D; (v) provision of modern integrated computer facilities in all units of ITI; and (vi) preliminary investment in a new project for manufacture of electronic exchanges to commence production during the seventh plan.

With all these activities coming into operation, telephone lines are expected to increase from 280,000 to 600,000 in number.

First Indigenous Direct-Data Entry System Developed

The first indigenous multi-terminal direct data entry system has been developed by Processor Systems (India) Pvt Ltd, Bangalore, a small-scale production unit.

This system, which has been developed in collaboration with ETTDC, will prove a blessing to a wide range of users in technical, commercial, industrial and other establishments which have voluminous data for computer processing. It will help both to speed up data entry and to reduce the cost of producing error-free computer data.

This eight-bit processor has 11 positions for data entry for simultaneous operation by eleven operators. Moreover, it is capable of accepting data from as many as 16 video terminal positions to perform a mixed task of data entry and file management.

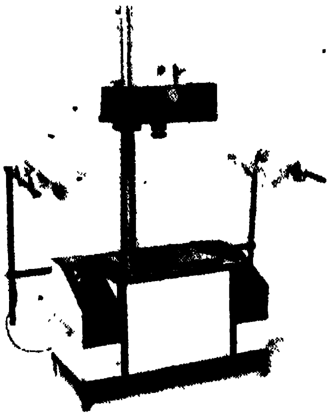
The ETTDC has already been able to secure export orders for about Rs 400,000 for this system, according to its chairman and managing director, Mr R.M. Nayar.

NRSA Develops Microfiche Camera

The National Remote Sensing Agency (NRSA), Secunderabad, has developed a microfiche camera which will assist it immensely in storing the enormous amount of aerial and satellite remote sensing data it obtains for its natural resources surveys.

The entire photographic equipment comprises three sub-units—the camera unit, the lens unit and the light and exposure control unit.

The camera unit has an arrangement to carry and slide film cassettes in two mutually perpendicular directions. The camera can be operated in daylight and has been designed to accommodate 145mm x 105mm microfiche sheet film to store 20 formats of micro images on it.



A 35mm wide angle lens is used. Fitted to this is an electromagnetic timer.

The light and exposure control unit has lighting arrangement for both the transparency and reflection modes. For the former mode, the unit has a light intensity control to accommodate wide density variations in the originals.

Besides being cheap and easy to operate, the equipment has such other advantages as: (i) the camera can be focussed on a ground glass cassette; (ii) number of formats can be changed by changing the slit and cams, and (iii) the material to be photographed can be handwritten, printed or typed.

TV Prices Raised

Due to the increase in excise duties, the retail prices of TV sets have been raised so that each set will now cost Rs 200 to Rs 400 more. A 'Janata' multichannel TV set priced at Rs 1750 will now be dearer by at least Rs 200 to Rs 400 if the increased excise duty on components is also taken into account.

During 1978, the output of TV sets in the country was around 280,000 against the installed capacity of 500,000. It is feared that the production and sale of TV sets in 1979 might stagnate at a level below 300,000 sets. The demand for TV sets had increased with the introduction of cheaper 'Janata' sets in 1977 and 1978

New Director-general of Doordarshan and AIR Appointed

The secretary of the Information and Broadcasting ministry, Mr S. K. Sahgal, took over as director-general of All India Radio and director-general of Doordarshan on April 1, 1979.

This is a temporary arrangement as the future set-up of the two organisations is likely to be decided upon at the end of the current year.

It is reported that the recommendations of the Verghese committee are still being processed in the Ministry of Information and Broadcasting.

R&D Funds Under-utilised During 1978-79

The minister of state for electronics, Mr Sher Singh, admitted in Parliament recently that of a total of Rs 47.5 million provided for R&D during 1978-79, Rs 8 million could not be utilised.

According to Mr Singh, the reasons for this were varied. First, certain projects for which R&D funds had been set aside were either rejected or deferred by the Technology Development Council (TDC) and the National Radar Council (NRC), the subsidiary bodies of the commission through which the Department of Electronics' R&D projects are undertaken.

Second, some requests for releases received from project executing groups during February/March 1979 were held back for actual releases in April/May 1979, as it was certain that even if the money was released it could not be spent by March 31, 1979.

Third, as the liberalised scheme under which R&D institutions can import directly on OGL has been approved for only one year, project executives found it difficult to raise indents for the last three months of the financial year, as payments for these had to be made within that year.

The minister, however, did not think that this under-utilisation of funds would affect technological development in electronics. This is because many of the proposals rejected earlier on grounds of technical non-viability are expected to be considered favourably when they are reformulated on the basis of the recommendations of the TDC or NRC.

New Import Policy Delayed

The import policy for 1979-80 has been delayed and will now be announced on 1st May, 1979.

Accordingly, it has been decided that:

(i) The provisions of the current policy for import of items under Open General Licence which expire on 31st March, 1979 will continue up to 30th April, 1979;

(ii) All exports made up to 30th April, 1979 will qualify for import replenishment licences in terms of the current policy;

(iii) Advance licences will continue to be granted up to 30th April, 1979, in accordance with the current policy;

(iv) The existing provisions for the import of emergency spares will continue;

(v) Canalising agencies will continue to supply the respective items in accordance with the earlier registrations; and

(vi) Persons who need to import any requirements under extraordinary circumstances during this period, may apply to the Chief Controller of Imports & Exports, New Delhi.

The provisions of the current policy relating to registration of contracts will continue to be available to registered exporters up to 30th April, 1979.

Collaboration with EEC for Software Export to Third Countries

The 31-member delegation of computermen from the Common Market countries visited India last month to explore possibilities of collaboration.

Discussions with Indian computer companies led to the scheme of joint ventures in third countries in West Asia, Africa and Europe. The European companies were willing to supply hardware. With software from India, the joint venture could operate profitably in third countries.

Since microcomputers are the latest craze in the EEC region, programmes for these computers can be developed in India. EEC countries have an annual business of the value of $4200 million in software. Our country can certainly take a share in this business if the government allows the import of minicomputers of the latest type for working out software programmes.

The delegation from EEC was headed by Mr Suresh Bir, chief administrator in the office of the Directorate General of Industries in the Common Market.

New Export Policy

The export policy for 1979-80 has stipulated the canalisation of the export of video tape cinema films, including cassettes, through Indian Motion Picture Export Corporation.

New cash aid rates applicable to exports of electronic items from April 1, 1979 have also been announced for a period of three years. For exports by sea, the rate has been lowered from 17.5 per cent to 15 per cent. It continues to be 17.5 per cent for

exports by air. Both these rates apply to electronic instruments and appliances.

The rates are however different for transformers (15 per cent); permanent magnets (7.5 per cent); computer services and software (12.5 per cent of net foreign exchange earnings); and gramophone records (5 per cent).

Spain Beckons Component Manufacturers

In a recent survey undertaken by the Trade Development Authority (TDA), it was found that Spain could prove to be a virtual gold mine for Indian electronic components manufacturers.

The electronics industry in Spain has been developing very fast. As a result, local production has been unable to satiate the home demand, leaving a large scope for imports of electronic components and finished products.

Export possibilities for electronic component manufacturers are further enhanced because there are no quantitative import restrictions in Spain in the case of components Such restrictions are imposed on import of consumer electronic products Manufacturers of consumer products can however export their products to the Canary Islands nearby, which is a free port.

Among the various electronic items which are in great demand in Spain are, according to TDA, consumer electronics products such as radio-cassettes, amplifiers, speakers, calculators, electronic watches, TV sets and TV games; and components such as valves, semiconductor devices, ICs, capacitors, resistors, transistors, diodes, ferrites and switches. Import duty for these varies from 20 per cent to 30 per cent.

According to the TDA survey, efforts should be made to exploit the Spanish market by sending offers giving specifications, prices and illustrative catalogues. Here, it should be kept in mind that Spanish electronic products are of a superior quality as a number of multinationals such as Grundig, Philips, Sony and Telefunken have collaboration ventures in Spain. To be considered for import, Indian products must be at least as good as, if not better than, these products.

CEERI Workshop on Electronic Instruments for Sugar Industry

The Central Electronics Engineering Research Institute (CEERI), Pilani is organising a workshop on electronic process control instrumentation for the sugar industry from the 21st to the 25th September, this year.

The main objective of the workshop is to bring together sugar technologists and instrumentation engineers, and to exchange viewpoints and ideas in the field of electronic process control instrumentation for the sugar industry, with special reference to their application.

Chief among the topics which are proposed to be discussed in the 5-day workshop are (i) instruments for measurement of basic variables encountered in the sugar industry; and (ii) calibration and maintenance of electronic instruments in this industry.

For further information, please contact: Mr G. N. Acharya, Chief Co-ordinator, CEERI, Pilani.

And Abroad ...

Britain to Hold an Electronic Fair

Sponsored by the Electronic Components Industry Federation in Britain, 'Electronics 79' is a widely publicised electronics components industry fair to be held at Olympia, London from 20th to 23rd November, 1979.

The organisers of the fair have already claimed it a big success with about 82 per cent of the exhibition space having been booked. The 200 companies and organisations who have booked space till now include such electronic giants as Thompson-CSF, Gould Advance and AEG-Telefunken.

'Electronics 79' is the new name given to the 'London Electronic Component Show' held 28 times in the past. The change in name reflects changing times in which yesterday's systems have become today's components, so that companies that were previously ineligible are today eligible for participation in the show.

For further information, please contact: Mr Terry Hill, Sales Manager, Industrial and Trade Fairs Limited, Radcliffe House, Blenheim Court, Solihull, West Midlands B91 2BG.

Word Processing Exhibition to be Held in Britain

The International Word Processing Exhibition will be held at London's Wembley Conference Centre from 10th to 13th July, this year. Organised by the national body of Britain's office equipment industry, the exhibition is claimed to be the largest of its kind in Europe.

Expected to make an impact at the exhibition is what is currently known as a WP systems co-ordinator. This can be used to form the nucleus of a centralised print unit using daisy wheel, dot matrix, ink jet or line printer, and has been given British Post Office approval for connecting to the telephone for transmitting data at hundreds of words a minute. Moreover, it can be operated four or five times faster over tied lines.

Also displayed at the exhibition will be London-based Dataword Equipments' 500-word-a-minute printer linked to two floppy discs, each able to store up to 40 pages of A4 (sheet size) typing. Any piece of text can be located in half a second, and a large memory allows unattended playout.

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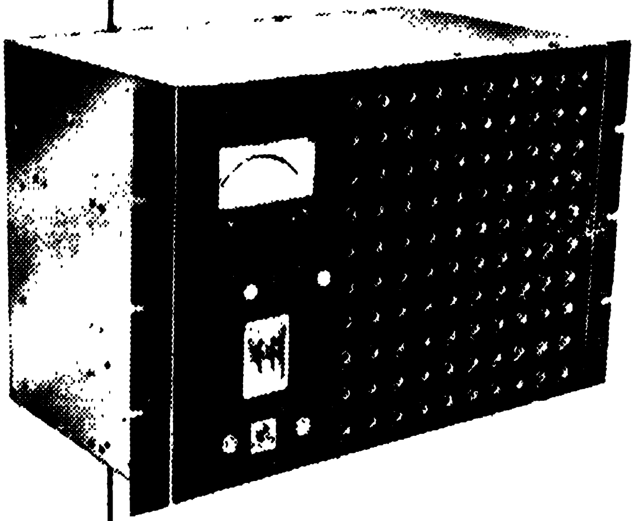

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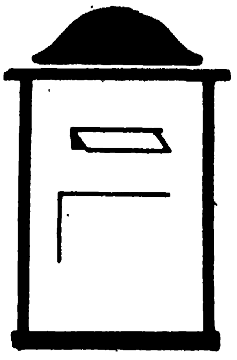


LETTER

BUCK-UP EFY!

Electronic hobbyists are indeed grateful to EFY for its efforts to publish circuits of practical interest to many and maintaining a good standard all the time. But EFY will do better if the following aspects are kept in view:

1. Many circuits published in EFY have some alteration or modification which, however, is published after a few months. An enthusiast cannot wait for such a long time and his initial enthusiasm in trying out the circuit at the earliest will come down with the disappointing results due to a faulty circuit. Hence only thoroughly tried-out and flawless circuits should be published.
2. Integrated circuits are becoming increasingly popular with the indigenous development and manufacture of different types of ICs growing rapidly. I feel EFY must dedicate a regular construction feature to ICs every month. For example, a good quality FM/AM tuner using BEL 700 IC will be welcome by stereo fads. Or a construction project of a good quality stereo cassette deck based on ICs and components available in our country will greatly help those enthusiasts who cannot afford to buy the prohibitively costly decks in the market.

I am sure EFY would enhance its value and usefulness with such additions.

J. B. PRASAD
Hyderabad

☐ I thank you very much for your most sincere efforts in the promotion of electronics industry in India Your magazine no doubt is the only one of its kind in furnishing details of all kinds related to the field of electronics. I am subscribing your magazine since I was a student of electronics engineering at BITS, Pilani (Rajasthan). I have great pleasure in expressing that your magazine not only compares with any foreign magazine but is the best for our environment.

A. K. NOPANY
Akay Electronics, Calcutta

SCREEN PRINTING TECHNIQUES

I was glad to see the Jan. '79 issue.

Circuit Ideas, Construction article, Letters and the article on 'Screen Printing Techniques for the Electronics Industry' were very much interesting, informative and easy to understand.

I would, however, like to request you to refer to page no. 27 where the sensitisers normally used for the purpose are given as potassium dichromate, ammonium dichromate or sodium dichromate. As far as I know, 'bichromates' are used for the purpose.

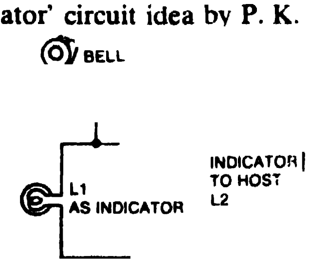
V. S. PADALE
Bombay

Mr V. K. Haridas, author of the article clarifies :

The correct names of these chemicals are: potassium dichromate, ammonium bichromate, and sodium bichromate. I am sorry for the error.

'WAIT PLEASE' INDICATOR

Please refer to the 'Wait Please Indicator' circuit idea by P. K. Maheshwari and B. K. Kakkad in the Jan. '79 issue.



In Fig. 2 the switch is provided in the 'N' line, but as far as safety and general practice is concerned it should be in 'P line.

Also, with a little modification (as shown) in the circuit the relay used for holding visual indication 'on' can be omitted.

V. S. PADALE
Bombay

Mr Maheshwari, a co-author of the circuit idea replies:

In the figure, 'P' stands for phase and 'N' stands for neutral. Its correct that for human safety the switch should be in phase line. But in Fig. 2 the switch S1 was shown in neutral line to minimise wiring. Besides, S1 is only a changeover switch. The main switch (the push-button type, which is normally open) is already in phase line.

The modification suggested may not be useful as it will not give the indication whether somebody is waiting outside or not. Whereas in my circuit as soon as the push-button is pressed, it gives an indication to the host as well as to the visitor, and the indication is 'held' by 230V relay. So the relay is essential.

'MINI COMPUTER' IDEA

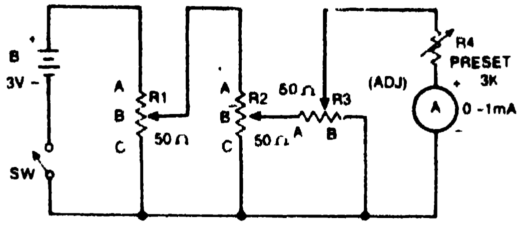
There appear to be some mistakes in the circuit idea for 'Mini Computer' published in Sep. '78 issue:

1. If the given procedure is adopted, the deflection in the meter cannot be obtained, because when R1 is at 'C', the potential available for R2 will be zero.
2. In para 5, line 5, for max. deflection adjustment R3 should be used and not R1, as printed.
3. As such there is no protection for the meter when R1, R2 and R3 variable points are at the max. potential, i.e., points 'A'.

The modified diagram given below will, however, satisfy the requirement.

For operation, set R1, R2 and R3 at points marked 'A'. For full-scale deflection, adjust preset R4. For fine variation R3 can be used.

After adjusting for full-scale



deflection, set R1's variable contact at 'A' and slowly include resistance in R2. According to meter reading, markings can be embossed.

Similarly, keeping R2's variable point at 'A', adjust R1 to get markings.

The remaining procedure will remain the same.

M. R. S. N. ATHREYAN
Tiruchy

Mr Kashi Nath Gosh, the author of the circuit idea replies:

I am thankful to Mr Athreyan for his comments on my design. The points 1 and 3 have arisen due to omission of a paragraph during the typing of the manuscript. I am sorry for this.

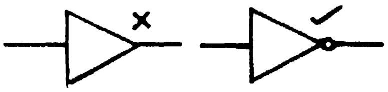
I request Mr Athreyan and other readers to read the following as paragraph 2:

"For calibration, keep R3 at its off position, and turn the knobs of R1 and R2 to their fully on position. It is now safe to apply power. Flip on the input supply switch and slowly turn R3 knob till the meter reads '1', the highest number on the scale."

Besides the above omission, a mistake has also crept in: 'R1' in para 5 (now para 6), line 5, should read as 'R3'.

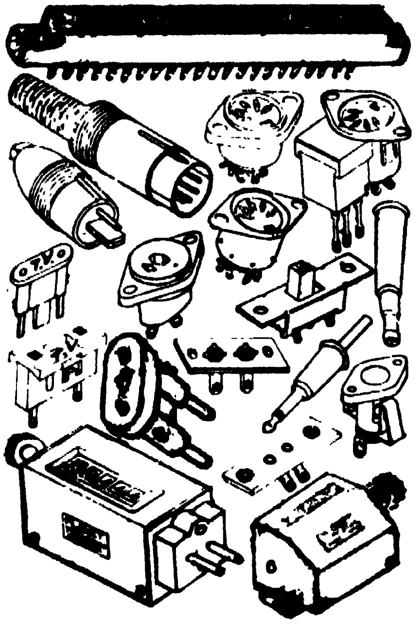
PLEASE CORRECT

1. In the 'Binary State Indicator' circuit idea published in the March '79 issue, please read IC No. 7432 as 7430. Also the symbol of the inverter has been wrongly drawn in the circuit.



2. In the 'Split Phase Power Supply' circuit idea published in the Feb. '79 issue, the working voltages of capacitors C1 and C2 should be read as 16V/25V.

—Managing Editor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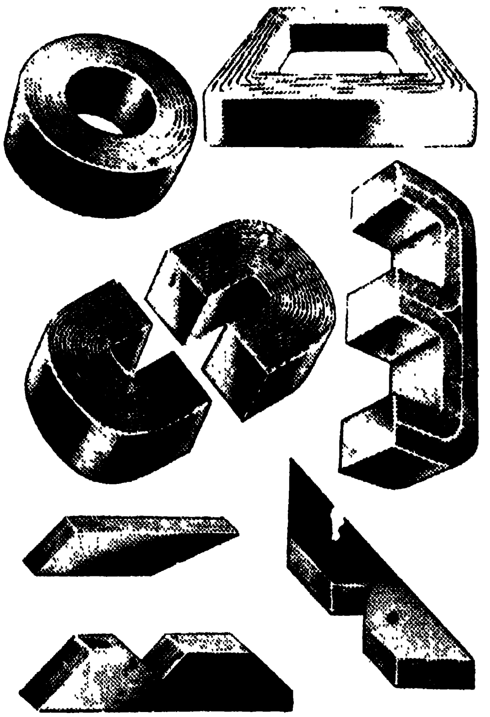
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DIGITAL DISPLAYS—FUTURE TRENDS

A. A. Alvares

Since digital display systems are free from reading errors, unlike analogue systems they are widely being used not only in military equipment but also for industrial and consumer applications.

The predictions for the optical display industry released by the Creative Strategics International (CSI), a California-based research and consulting firm, is that liquid crystal displays (LCDs) will experience dramatic growth, showing a 25 per cent compound annual growth rate through 1982. Technological advances will, of course, continue beyond the five-year forecast period, ultimately leading LCDs to the top position in the display industry by mid-1980s.

LEDs will, however, remain the leading industry segment in terms of sales in the early 1980s, primarily due to low prices and extensive use in consumer goods. It is also anticipated that LED displays will move away from the single-digit display to multiple-digit LED sticks and dot-matrix displays during the next five years.

Liquid crystal displays are increasingly in demand these days, because they are so frugal in their use of power that flexible electronic firms are jumping on the bandwagon and turning out every conceivable product that can utilise LCDs.

Currently, LCDs for calculators are the best sellers but electronic watches and clocks are not far behind. LCDs are now expected to move beyond the watch market and expand into many new applications such as measuring instruments, wall displays and controls. Major improvements will be in the areas of multiplexing LCD digits and in improved colour capabilities. The demise of LED watches was due to the inability of makers to make them thin enough for usage, besides the current drain being more than in LCDs which are superseding them.

While the manufacturers will be happy to trade up to LCD products as they foresee more profits to be had, the suppliers are a little perturbed that "jumping on the bandwagon" may cause severe disruption in the market, resulting in prices crashing down to unacceptable levels. However, prices are expected to stabilise some time this year.

Electro chromic display

While the battle for supremacy between LED and LCD is on, researchers have unveiled yet another display—namely, electro chromic display (ECD).

The ECD, though a successor to the liquid-crystal display (LCD) in terms of technology, has a bright future. The display, whether numbers or letters, is indicated in blue against a white background. Unlike LCD, the ECD can be easily read from any angle. It also has a high contrast, and the colour remains even after the voltage is cut off.

The intensity of the colours can be controlled by varying the potential during colouration process, and this allows gradation displays. The display can be driven by a single battery and its power consumption is slightly more than that of an LCD but less than that of an LED.

It is generally believed that this new display will be suitable for clocks and watches and also for large-scale public displays used at stations and airports.

Gas discharge displays

Another generation of displays—namely gas discharge displays—have been in existence for some time now and are finding new applications. These provide some of the most readable displays available today and can be used in virtually unlimited applications. They can be used in either DC or multiplex mode, thereby expanding the variety of application possibilities. Zero suppression, dark operation and multiplexed performance are enhanced through the use of one or more 'keep-alive' cathodes.

Manufacturers are finding a cost-effective means by which to improve sales, as these displays provide the end product with improved readability, a wide 130° viewing angle, reliability, low power consumption, and smaller, less expensive power supplies. They also interface directly with TTL,CMOS and MOS/LSI.

Gas discharge displays will continue to be somewhat competitive in certain applications in single-digit areas. However, the key growth area will be panel displays. Many new microprocessor-based systems are expected to provide the stimulus to open the dot-matrix panel display market place.

Fluorescent display tube

Yet another class that has found wide acceptance is the fluorescent display tube (FDT). The development of fluorescent display panels (FDPs) has greatly expanded applications for fluorescent display tubes. Therefore, fluorescent display tubes, whose applications were mostly confined to calculators, have come to be utilised in almost all areas where small-size displays are required. Also, new applications are being developed for utilising fluorescent display tubes.

Unlike many other display devices, fluorescent display tubes underwent three major innovations. The first fluorescent display tubes were single glass tubes with ceramic substrates and anodes arranged and sealed in the tubes, which also found extensive applications in calculators.

The second innovation was multi-digit cylindrical tubes or long glass tubes with ceramic substrates and anodes arranged and sealed in the tubes, which also found extensive applications in calculators.

The third innovation was flat fluorescent display panels, which consist of substrates with anodes formed on a glass sheet, for which a glass front is utilised to seal the substrate. This was realised through the utilisation of thick-film technology which was widely employed for hybrid IC manufacture.

These fluorescent displays are expected to find extensive applications in the future, as instruments and equipment become increasingly electronic and automated through the utilisation of LSIs and microcomputers.

Alphanumeric displays are today dominated by four technologies—planar gas discharge (PGD), light emitting diode (LED), liquid crystal display (LCD) and fluorescent display tubes (FDT)

Competition between these four is not always direct. In different market segments, each type of display can be compatible with certain end products. However, occasionally one technology will confront another. □

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INDUSTRIAL AND TECHNOLOGY POLICY FOR MINICOMPUTER/MICROPROCESSOR BASED SYSTEMS

The Department of Electronics has recognised that minicomputer/microprocessor based systems can bring significant cost reductions, design simplifications and better flexibility in industry apart from finding a wide range of applications in a number of other areas of the economy. The minicomputer/ microprocessor industry would, therefore, be one of the major thrust areas to be grown in the field of computers.

Based on capability, size and structure of the system as well as type of application, minicomputer/microprocessor based systems can be classified into the following usage categories:

(i) Dedicated applications (OEM* options for specific functions on a real time basis with nominal peripherals).

(ii) Standard on-line applications (OEM* option with peripherals and software).

(iii) Major on-line applications; and

(iv) Stand-alone systems.

The following guidelines would be applicable for approval of proposals for the manufacture of these systems:

The major objectives in the development of the minicomputer/microprocessor industry would be setting up of systems engineering companies which are not necessarily engaged in the manufacture of central processing units (CPUs) or peripherals. Manufacture of processors of peripherals will, however, also be permitted to produce minicomputer systems. For dedicated applications, e. g. direct data entry, accounting/invoicing machines, data acquisition systems, type setting applications, and dedicated controllers, medium and small-scale entrepreneurs with a technical background would be preferred. For requirements of on-line and stand-alone applications, units from the organised sector would be considered. Qualified individuals/groups abroad wishing to return and invest in minicomputer related industrial programmes, would be actively promoted.

While examining applications for industrial licences/small-scale approvals, a detailed scrutiny will be undertaken to ensure that the application areas in which the minicomputer/microprocessor system is to be used, are in tune with national priorities. The industrial licensing policy will also continue to be restrictive in areas where labour displacement is likely to be involved.

Foreign technical collaboration for high performance peripheral units would be permitted on a selective basis. Electronics being an industry which thrives on sophistication, in exceptional cases where it is demonstrably in the interests of quality and sophisticated electronics development in the country, foreign technical collaboration may be permitted; otherwise no foreign financial or technical collaboration would be permitted for companies wishing to make minicomputer systems. Foreign brand names may be permitted to be used for the explicit purpose of promotion of export sales. Indigenous brand names should be evolved for the domestic market.

To facilitate programmes for the systems engineering of minicomputers, industrial capacity for the production of a standardised range of peripherals and CPUs would be built up on an OEM basis, so that there is free indigenous availability at reasonable prices of the basic building blocks for minicomputer/microprocessor based systems. In this regard, peripheral units, semiconductor elements involved in CPUs, and consumables, would be standardised to the maximum possible extent and licensed/approved companies would need to configure their systems around these standard building blocks.

Until indigenously produced peripherals and CPUs are available, efforts will be made to import certain preferred components, CPUs and peripherals on a stock-and-sale basis to obtain price advantages. However, wherever system/companies/users are in definite need of acquiring peripherals/processors outside this range, the Department of Electronics will recommend ad hoc import clearance after due review.

The performance of the units licensed/approved to make minicomputer/microprocessor based systems would be reviewed periodically (annually to begin with) and expansion of capacity approved on the basis of these reviews.

All pending applications will be scrutinised by the government and duly disposed of. The viability of the applicants in terms of their R&D facilities, capability to maintain standards and quality, current infrastructure and future potential would form the basis for such scrutiny. Fresh applications will be called through a press note only after the pending applications are decided. ☐

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*OEM—Original equipment manufacture.

A copy of this government policy for minicomputer/microprocessor based systems was provided by Prime Minister Morarji Desai in Lok Sabha, on March 28, as an annexure to a reply to a written question by two members of Parliament.

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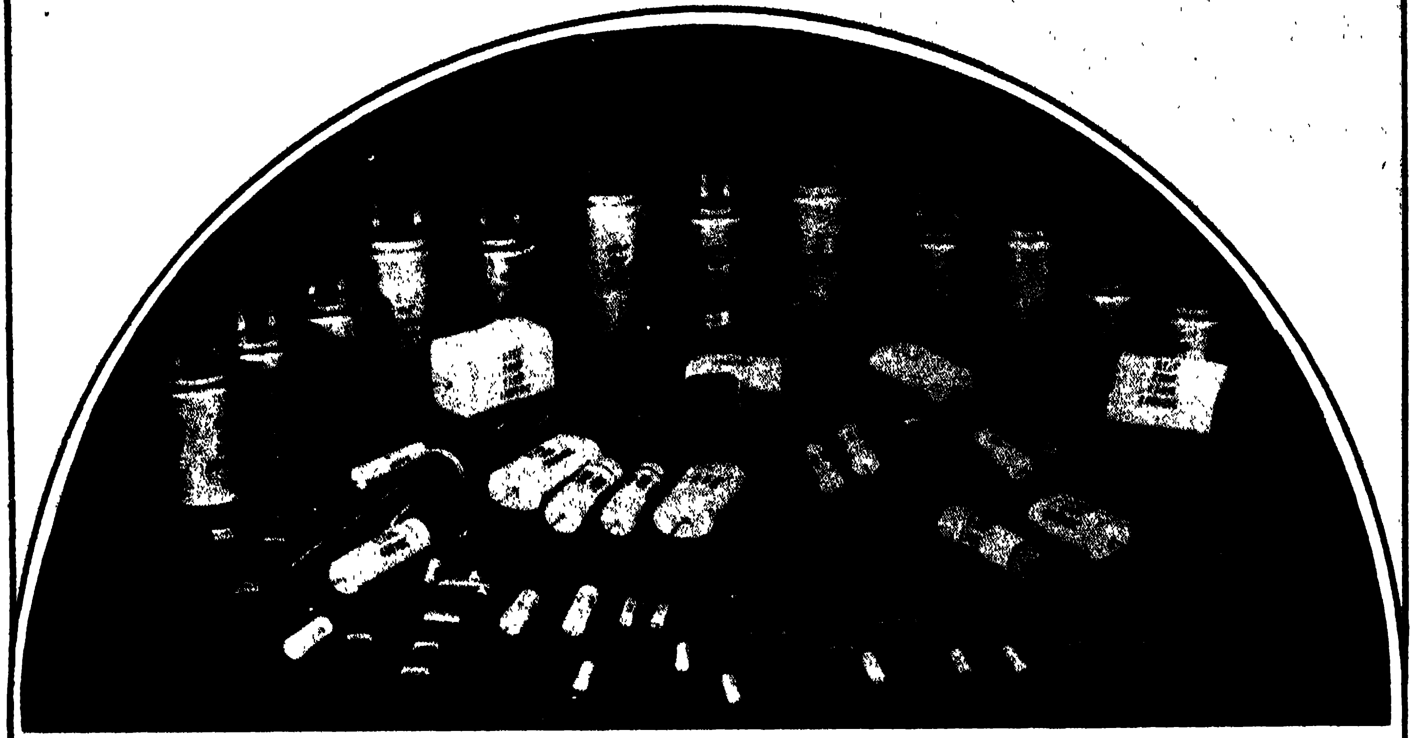

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MEASUREMENT OF INDUCTANCE
Some Problems and their Solutions

L. Devamoni

The measurement of inductance can still pose a problem in this age of digital instrumentation and automation. Most people who are concerned with component testing have very little trouble with resistance or capacitance measurement. But quite often the measurement of inductance presents problems which cannot be overcome with the usual type of universal bridge. Numerous observations made in laboratories and test departments are furnishing ample proof that important fundamentals of science of electronic measurements are apt to slip our minds in spite of, or perhaps because of, technical progress. This article explains the reason for the difficulties and provides some guidelines for their removal.

Inductors are impure elements and have significant resistance at measurement frequencies and also core loss, which absorbs energy from the source. Due to these unavoidable losses, an inductor can be thought of as a pure resistance in series or shunt with a lossless inductance (Fig. 1). The series circuit meets our expectations best, especially if the losses are mainly caused by resistance of the winding. This is the case particularly with air-core coils. If there is a solid core, the losses with increasing frequency no longer result from the copper resistance but due to losses in the core. It is a good practice to consider them shunted across inductance.

Fig.

The inductance values of the equivalent series circuit are not the same as in the equivalent shunt circuit. The conversion of the values in the one circuit into those valid in the other can be made using familiar equations, provided the equivalent loss resistances 'Rp' and 'Rs' are known. However, it is much simpler to calculate with the value of the coil Q:

$$Q = \frac{wLs}{Rs} = \frac{Rp}{wL}$$

The parallel inductance then is

$$Lp = Ls \left[I + \frac{I}{Q^2} \right]$$

and the series inductance is

$$Ls = \frac{Lp}{I \quad I}$$

As can be seen, the difference between the two inductances decreases as the 'Q' increases. Of course, if Q of the inductor at the test frequency is sufficiently high it matters little how the inductor is measured as the relationship between the series and parallel values is given by:

$$\frac{\text{Parallel value of Inductance}}{\text{Series value of Inductance}} = \frac{I + Q^2}{Q^2}$$

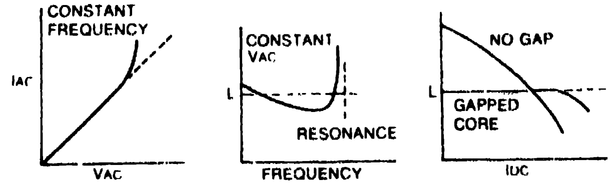

Fig. 2

The difference in value is only one per cent if Q equals 10 and about four per cent if Q equals 5. It is when Q is low that the difference is large; when Q equals one the ratio is 2 to1. For this reason, a distinction between the parallel and series inductances need be made only if the inductor has a low Q value at the measurement frequency.

Further, it happens in practice that most inductance bridges enable inductance measurements to be made only in the audio range where the Q of inductor is mainly governed by the winding resistance and may be very low. The results must be reckoned with in the overlapping region of the series and shunt arrangement of measurement facility in the bridges. The popular Hay bridge arrangement, normally used by manufacturers of power chokes and transformers, measures inductors under shunt conditions. The Maxwell bridge measures the inductor as a series arrangement (Fig. 2).

Inductors are also non-linear, and a plot of current against voltage at a constant frequency would not be a straight line. In a typical inductor the line would also be bent if the frequency was varied while the voltage remained constant, or if a direct current component was varied while all other conditions remained the same. These variations are illustrated in Fig. 3.

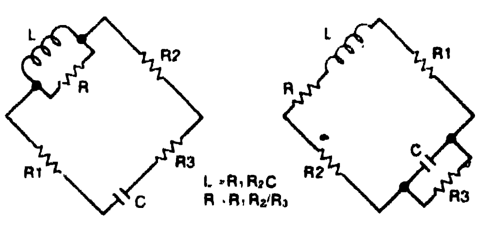

Fig. 3

Non-linearity is mainly due to the magnetic core of the inductor. Air-cored inductors are usually very linear up to the frequency at which the effects of distributed capacitance become significant. The changes can then be relatively rapid as the capacitance effect is predominant.

Non-linearity of magnetic core permeability is due to the complex way in which the magnetism of the crystal structure of basic material varies as the magnetising field is changed. In general, if the magnetic circuit is diluted with non-magnetic material, such as air or neutral material in the magnetic circuit, then the non-linearity is reduced.

Non-linearity of permeability is the principle factor which makes it imperative for an inductor to be measured under specified conditions. It is the failure of operators to realise this point, or perhaps the failure of someone to adequately specify the conditions, that mostly causes disagreement between two inductance values in a batch of similar inductors.

Non-linearity has other effects when the inductor is used in an actual circuit. Suppose, for example, the inductor is to be used in a filter. It can happen that the inductance may be different in the circuit from the test conditions, owing to different operating currents. This may affect the filter performance. Again, a filter intended to reduce harmonic distortion may actually increase the distortion owing to the non-linearity of the core. Cross talk or intermodulation is another possible result of non-linearity. All this stresses the need to control the measuring conditions of inductors with magnetic cores.

Inductance values usually vary with the following parameters:

1. Alternating voltage level.
2. Direct current component through inductor.
3. Frequency of measurements.
4. Capacitance and inductance of connecting leads.
5. Mode of measurement.
6. Previous magnetic and mechanical conditions of the inductor.

Many inductor specifications are vague so that, in the absence of instructions to the contrary, any bridge is used for the measurement and the result assumed to be a true value even under operating conditions. If the inductor manufacturer and user happen to adopt approximately the same measurement technique then they will be fortunate enough to be in agreement. But the user may be disappointed if the inductor does not fit his circuit application in practice though it apparently should in theory. A proper specification would overcome the discrepancies. □

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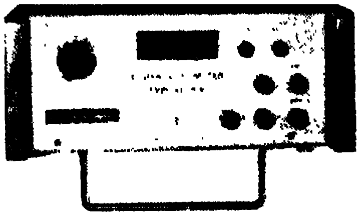

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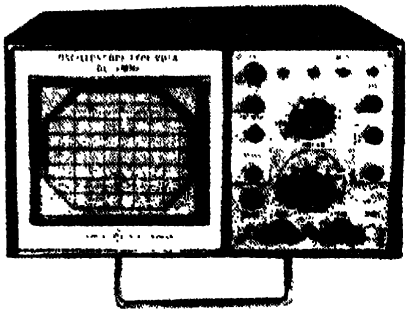

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Interview: Om Wadhwa

"The Whole World is Open to India"

It is generally agreed that there is a great potential for export of electronics goods and components from India. Yet the total exports of the Indian electronics industry have been far from spectacular.

To find out the reasons and their remedies, EFY's managing editor met Mr Om Wadhwa, chairman and managing director of J.V. Electronics Ltd, in his office.

Mr Wadhwa's company has been very successful in exports. It is exporting its entire production in the form of silvered mica plates and sections, and mica capacitors. Starting with Rs 1 million worth of exports five years ago, its turnover is expected to exceed Rs 20 million this year. Its last year's exports were worth more than Rs 12 million.

Q: What is the potential for export of electronic components from India, in your view?

A: There is a great potential for export of electronic components from this country. I say this for two reasons. First, as you know, electronics industry is labour-intensive. And there is an acute shortage of labour in the 'electronically' advanced countries. Let us take Taiwan. There is very little labour available(there) today.Their total population is just 10 million, and out of that the working population is not more than half. So, there is no labour available there. South Korea is expanding very fast. There is no labour available in Hong Kong and Singapore either. But, labour is one thing which India has in abundance.

Second, we have a wonderful technical base. As you know, India is the tenth largest industrial country in the world. Suppose, tomorrow you want to start an industry in Malaysia or in Thailand, then you have to have the basic technical background which they don't have, whereas we have such excellent engineers in this country who have not only helped in setting up units in India but have done the same in countries like America and England.

So, both these things, which make a good electronics industry, are available in India.

Q: So, as you say, the potential is there. Then, where do we run into difficulty?

A: The difficulties are two First is the government formalities. It takes so much time here in getting anything going. In Singapore, on the contrary, they welcome people wishing to set up units with a band. That may be an extreme case, but what I want to say is: Supposing you want to start a project in Hong Kong, South Korea, Singapore etc., I feel you can get going in about 90 days. Here (in India), if you are lucky, you can start a project in two to three years!

I give you an example. I have a project now, in hand, with an English company. It has already taken me more than six months, and I don't even know where we are going! You have to have a customs bond for export, then you have to get a licence—there are so many delays at every stage. That is why people (abroad) are so scared and indifferent.

We have therefore suggested to the government, through ELCINA, that there should be no licensing in the case of electronics industry. But if that is not possible, let us reduce the formalities so that one may get going within 90 days.

Second, it is not easy to get a good partner. When you want to have a collaboration, two things are required—technical knowhow and the personnel. When you go to Japan, you come across so many business-minded people. In India, people are just coming up in the electronics business field. As you know very well, a few years ago we didn't have any electronics industry.

So, if these things can be made available—the person who is wishing to give the technical knowhow, and the person who can put that knowledge to use in India, plus reduction in the government formalities to the absolute minimum—we can have a very good electronics industry in India. It has happened in Taiwan, it has happened in South Korea, it has happened in Hong Kong, it has happened in Singapore. This would mean millions of jobs for India and large foreign exchange earnings.

Q: What are your views on the import of technology in the field of electronics?

A: I feel you have to have a free import of technology when it comes to an export-oriented industry, or even for the entire electronics industry. There are a lot of people who are doing it in a difficult way.

The first time I went to Taiwan 10 years ago, there was no electronics industry there. Today, if you go to Taiwan, you will find it is full of electronics units. Same is the case with Singapore etc, and most of the units are export-oriented.

So, either we should be allowed to buy technology, or allowed collaboration, or at least allowed free import of technology either on the basis of royalty or through collaboration—preferably through the latter because then the foreign collaborator can be made to buy back most of the production.

The whole world is open to India, it we can meet these three requirements. After all, where are they going to go now? There is no other country I can think of where labour is available in plenty right now, except for Thailand. But that is not very stable, politically,and has very small technical base as you know. Then there is Egypt, and now China is opening up. God knows what will happen, whether Americans will go there or not.

Q: What are your views on foreign collaboration?

A: I think any company that allows a minimum of sixty per cent buy-back is safe. Because this means you are going to get your money back, plus it will offer employment to workers and engineers.

You know, there is an acute shortage of components in our country. We are unable to produce on our own—we are doing it the difficult way. By the time we start producing, the components will become obsolete. So, we will always lag behind.

CB radio was a big craze some time ago, though now there is very little demand. Japan made a big profit in that. In three years they shipped millions and millions dollars worth of CB sets. India doesn't even know CB radio.

Q: How is the image of Indian electronic products abroad?

A: Let us be honest about it. The whole image of India as an exporting country is zero. Look at what has happened to the garments industry. Three years ago everybody was thinking that the garments industry is going to be a tremendous industry, but now we are in trouble.

The image is very bad, there is no doubt about it But one thing is there, once you have established a good image (as a company) by giving good product and service, then you do not have that problem.

Q: Are we competitive, price-wise?

A: I don't think there is any problem in competing price-wise, provided we have a well-organised business. It however depends on your volume of production.

Q: How is the labour situation in India?

A: Our labour is very good and efficient. We had worked out our costing on the basis of 80 per cent of American efficiency, but today we have reached 120 per cent of American efficiency. Besides, normally American workers do not work after 4.30 p.m. as they have one-shift system, whereas we can work 24 hours. In fact we have more people asking for the night shifts because they get more money, plus they can study or do something else during the day. And labour is available here for eight to ten rupee a day as against three to four dollars per hour in USA. ☐

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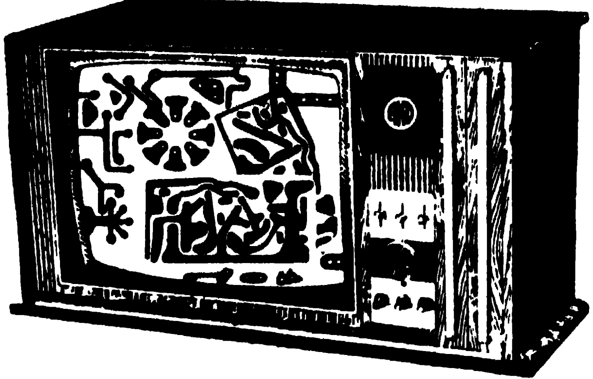

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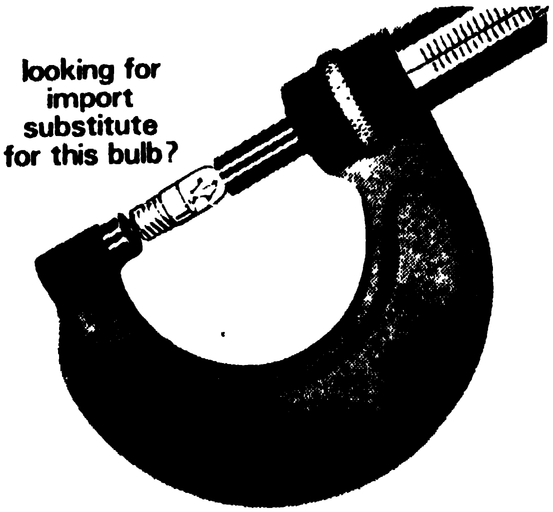

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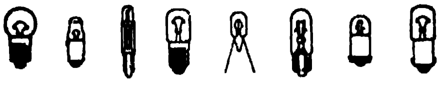

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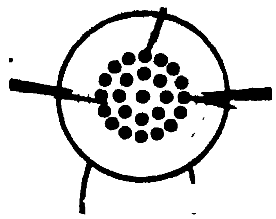

TELECOMMUNICATIONS IN INDIA

S. P. Chopra

The area covered by telecommunications today is extensive. It includes telephones, video telephones, microwaves, computers and satellites. Our country has taken rapid strides in this field, though the demand for telecommunication facilities exceeds supply by a wide margin.

ELECTRONICS FOR YOU has chosen to write this special supplement in this month because May 17, 1979, will be observed as TELECOMMUNICATION DAY all over the world. Our country's contribution to the spread of telecommunication in the world is of no mean order. At the end of last year, 38 out of 262 experts working under the auspices of the International Telecommunication Union were of Indian nationality. They represented more than 14 per cent of the total number of experts working for the benefit of the developing countries.

At Ahmedabad has been set up the first international training centre for the personnel of satellite telecommunication stations. Through the Satellite Instructional Television Experiment (SITE) our country has established the necessary infrastructure for the execution of the satellite project. The launching of an Indian National Satellite (INSAT) in 1981 will bring into service a national space telecommunication network which will cover 35 earth stations.

In the case of telephones, the demand in metropolitan cities exceeds supply but steps are being taken to cover up the gap during the next few years. Video telephone will take more than a decade to make its appearance in our country. Computers however are being employed to speed up communications by big enterprises such as Indian Airlines and Air India.

And all this is being made possible by a revolution in electronic communications. It is microelectronics in the form of integrated circuits which is bringing about far-reaching changes in telecommunications along with reduction in cost. From vacuum tube to transistor to integrated circuit is a revolution which has taken less than two decades to accelerate the pace of telecommunications at a breathtaking rate.

Our country has taken all the necessary decisions to establish self-reliance in technology and manufacture of systems and equipments, but it does not imply that imports are banned. Wherever necessary, import of components and equipment is resorted to; several countries including the USA, Japan, Sweden and Hungary have assisted in the establishment of a fast and efficient telecommunications system.

Immediately after Independence (1947), our country had 321 telephone exchanges with a capacity of 100,000 lines and with 86,000 working connections served by 426 long-distance (inter-city) speech channels. There were only 338 long-distance public call offices and 3324 public telegraph offices.

On April 1, 1978 the number of telephone exchanges was 6238 with 2.02 million lines and with 1.73 million working connections. The long-distance public call offices numbered 8883. These figures demonstrate the manifold increase in telephone capacity which has taken place during the past three decades.

All this was possible because the successive five-year development plans of our country laid stress on expansion in telecommunication facilities. The first five-year plan had earmarked an outlay of Rs 469 million, which steadily grew from plan to plan. The latest draft plan (1978-83) for the period has set apart a sum of Rs 18,480 million for telecommunications. The total expenditure on this sector of the economy during the planning period 1951-83 will come to Rs 38,875 million.

A word needs to be added about the subscriber trunk dialling (STD) facility which enables the subscribers to switch directly their long-distance calls. This service has been greatly appreciated by subscribers, though it has as yet been set up between a few important cities only. Since 80 per cent of India's population lives in villages, the government is taking steps to extend the telephone facility to rural areas as well. The draft plan for the period 1978-83 envisages the establishment of 15,000 long-distance public call offices for rural, hilly, tribal and backward areas of the country.

What is of great interest is that the government of India is committed to increasing indigenous equipment for the development of telecommunications in this country. Wherever necessary, imported equipment has been deployed but the use of indigenous equipment is bound to increase in the coming years which, in turn, is expected to speed up the operations of such companies as are engaged in the manufacture of telecommunications components and equipment. Here is a brief account of the undertakings which are engaged in the manufacture of telecommunications equipment:

1. Indian Telephone Industries Ltd (ITI)

This public sector undertaking is the largest manufacturer of telecommunication equipment in the country. It has units at Bangalore, Allahabad (Naini), Rai Bareilly and Palghat. Its total annual output is of the order of 1000 million rupees comprising telephone instruments, stronger exchange equipment (Pentaconta type), transmission equipment open-wire, coaxial and microwave radio, multiplexing equipments, testing instruments, and PAX/PAXB electronic types.

There is a chance of the fifth ITI unit being set up at Bhubneswar (Orissa). This will be the third switchboard and crossbar equipment factory of the ITI. This project is expected to cost about Rs 650 million. The state government has agreed to give 300 acres of land required for the factory and the colony, and has also assured the supply of power and water. The employment potential of the unit is 7000—both skilled and unskilled workers.

2. Bharat Electronics Ltd (BEL)

This is also one of the largest public sector undertakings specialising in the manufacture of telecommunication and electronic equipment. It has two units—one at Bangalore and the other at Ghaziabad (near Delhi) whereas another unit is nearing completion at Poona. It manufactures radio equipment, microwave equipment and troposcatter system besides transistors, integrated circuits, crystals, tubes, etc.

3. Electronics Corporation of India Ltd (ECIL)

It is located at Hyderabad (Andhra Pradesh) and fabricates test instruments, professional grade components, microwave antennae, television sets, and computers. It is an outstanding undertaking in the field of electronics.

4. Hindustan Teleprinters Limited (HTL)

Located at Madras, this public sector enterprise manufactures teleprinters besides a variety of telegraph items and computer peripherals.

5. Hindustan Cables Ltd (HCL)

Its factories are located at Hyderabad and Rupnarainpur (near Calcutta). The products manufactured are underground cables of different types required by the telecommunication sector besides coaxial cables, dry-core paper insulated cables, jelly filled PVC cables, plastic insulated wires and copper coated steel wire.

Besides these five public sector undertakings which largely provide indigenous components and equipments for telecommunication services, a number of states have set up units for the manufacture of professional-grade components and sub-systems of major communication equipment such as transreceivers, power packs etc. Also, three departmental telecommunication factories at Calcutta, Bombay and Jabalpur (Madhya Pradesh) are turning out a wide variety of telecommunication components and equipment.

There is no dearth of skilled engineers, mathematicians and scientists in our country. However, we have still to go far in catching up with the technical capabilities of the advanced countries. It is research and development (R&D) which needs increased attention in the coming years. The government of India has taken a first step by establishing the Telecommunication Consultants Ltd under the P&T Board.

Perhaps, for a long time, this country will continue to have the bullock cart and the jet plane side by side. To take the whole nation into the jet age will generate new demands for which the economy is not yet fully equipped. At a time when the advanced countries are taking to the latest and the fastest technologies, a debate is going on in our country whether to opt for 'Appropriate Technology' or the 'Latest Technology.' The slogan for appropriate technology is raised by those who are unnerved by the breathtaking advances in science and technology and advocate the adoption of the slow-moving methods of production and movement.

As stated earlier, technology is taking rapid strides in telecommunications—thanks to the revolutionary changes taking place in the fields of electronics and space research. Our government is fully alive to requirements of telecommunications technology in this country and has provided an outlay of Rs 500 million for this purpose in the draft plan for the period 1978-79 to 1982-83.

Developmental work in telecommunications is being undertaken by the Posts and Telegraphs (P&T) Department, the Overseas Communications Service, and the manufacturing units in the Ministry of Communications. The Telecommunication Research Centre (TRC) in Delhi is the technology development centre of the P&T department; it assists in the introduction of new technologies in the telecommunication network and services. The public sector undertakings listed earlier which manufacture telecommunication components and equipments are also engaged in R&D operations.

The Indian Space Research Organisation (ISRO), the Tata Institute of Fundamental Research at Bombay, the National Physical Laboratories at New Delhi and Central Electronics Engineering Research Institute at Pilani

Growth of Telecommunications in India Since 1948

	Position as of	
	April 1, 1948	April 1, 1978
Telephone exchanges	321	6,238
Local exchange capacity (lines in millions)	0.1	2.02
Working connections (DELs) (in millions)	0.086	1.73
Telephone sets (in millions)	0.17	2.25
Long-distance public call offices	338	8,883
Manual trunk boards	250	6,438
Trunk automatic exchanges (TAXs)	nil	17
TAXs capacity	nil	30,450
STD routes (point-to-point)	nil	114
Long-distance speech channels	426	48,637
Coaxial cable system (km)	nil	13,759
Microwave systems (km)	nil	13,275
Public telegraph offices	3324	19,774
Telex exchanges	nil	101
Telex exchange capacity	nil	19,865
Telex subscribers' connections	nil	14,641
Teleprinters	615	36,221
VFT channels	450	14,315
Capital investment (in million of rupees)	372.8	15,595.7*
Gross revenue earned during previous year (in millions of rupees)	127.8	4,859.4*

Revised estimates of 1977-78.

: some other institutions where R&D work is going on the time. The academic institutions such as the Indian titutes of technology at Delhi, Kanpur, Kharagpur, mbay and Madras, the Indian Institute of Science at ngalore and the Birla Institute of Technology at Pi-ii, also lend a helping hand in the development and option of the latest technology in this sophisticated ld.

Not that these institutes operate singly and separately; ey also work in cooperation with one another. Cur-ntly, the TRC of the P&T and Space Applications ntre of ISRO are jointly working on a project named 'EP—Satellite Telecommunication Experiment oject—making use of a Franco-German Satellite cal-d Symphonie. Work on this project started in June 77 and is expected to continue till the middle of the rrent year. Five stations—Ahmedabad, New Delhi, adras and two transportable terminals—are taking rt in STEP.

The cost of R&D being prohibitive, the private sector companies in this country are not very active in the field of telecommunications. Besides manufacturing simple fabrications and cables, they have left the field free to the public sector enterprises. Hence the slow progress of the telecommunications industry in this country.

The marvel of R&D lies in making new equipments more reliable. This may be explained with reference to the logic gate. In the age of vacuum tubes, the logic gate was highly unreliable. The transistors raised its reliability manifold. And now the integrated circuits have further enhanced reliability.

In the markets of the world, the production of integrated circuits has grown at an exponential rate consequently prices of integrated circuits have fallen steeply. We in this country have hardly made a beginning in this field. While our cost of manufacture is high, ICs from the foreign markets are being smuggled in at ridiculous prices. We have no option but to accelerate the production of ICs and fall in line with world markets in prices ☐

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SPECIAL SUPPLEMENT

SATELLITE FOR DOMESTIC TELECOM SERVICES

K. D. Vaidya

Telegraph and telephone communications in India began in the second half of the last century using openwire lines and grew progressively through this medium. The carrier communication on openwire lines started in the late thirties. The network of multichannel openwire carrier systems grew rapidly during the forties and thereafter, specially in the context of the second world war.

With the progressive increase in number of telephones, the demand for long distance telecom circuits grew manifold. For meeting this ever growing demand, the P&T Department took up the establishment of large capacity transmission systems in the early sixties. Today several thousand kilometres of coaxial and radio relay network is in operation in the country. On a large number of routes installation is in progress. However, in a large country like India where distances run into several thousand kilometres terrestrial communication systems have their own limitations. The equipment involved in such systems, covering distances such as from Leh to Trivandrum, is very large, thereby reducing the reliability. Moreover, remote places like Port Blair, Kavaratti etc cannot be easily reached by terrestrial systems.

Satellite technology has been rapidly developing for providing telecommunication needs on international routes from 1964 onwards. The early seventies saw the application of this new technology in domestic networks also.

The Satellite Earth Station is simply a terminal in a communication network which can transfer information or receive information from a satellite, acting as the familiar microwave repeater. The aspect of such a system is that a single repeater—namely, the satellite placed at an altitude of 36,000 kms can cover one-third of the earth's surface with adequate antenna beamwidth. Thus, the entire globe can be covered by placing three geo-stationary satellites at suitable positions and heights above the equator. Consequently, any pair of earth stations within the coverage area of a satellite can serve as a communication link.

Many member countries have taken advantages of the spare capacity of 'Intelsat' satellites to strengthen and expand their domestic networks, thus effecting a saving in time and money in launching their own satellites and in cutting down time involved in construction of terrestrial systems in their countries.

P&T's Project

The Indian P&T Department has also sanctioned a project costing about Rs 60 million which will provide reliable telecommunication facilities to remote unaccessible areas at Leh, Aizawl, Lakshadweep, Port Blair and Car-Nicobar islands using the presently well-proven satellite technology. These stations will be working with Delhi and Madras which will act as gateway stations linking them into the mainstream of the telecom network in the country. Earth stations will be set up at these places which will initially work with the Intelsat Indian Ocean Satellite.

The first and foremost task in setting up earth stations is the selection of sites. The main consideration while selecting these is the site's interference-free operation from other radio relay systems.

Earth stations operate on frequency bands which are common to terrestrial microwave communication links. Therefore, mutual interference problems have to be sorted out so that both earth stations and terrestrial links work within internationally accepted interference limits. The interference from high powered weather and other radars has also to be kept in view.

Initially, sites are selected on a map and the coordinates are fed to a computer for analysing the interference effects of existing stations around earth stations. This sometimes means calculating interference effects from 20 to 30 radio relay stations while establishing *one* earth station. The problem is quite acute for main stations like Delhi and Madras and a considerable amount of calculations and coordination with other users is necessary. This results in selection of earth station sites about 50-60 kms away from gateway trunk automatic exchanges especially in places like Delhi, Madras etc, and the circuits have to be extended from earth stations to these switching centres on rearward microwave links operating in bands different from satellite frequencies.

P & T has chosen the band of these rearward microwave links as 11 GHz. At the smaller stations these rearward links are either on coaxial or VF cables depending on distance and circuit requirements.

Preliminary works like selection of the site and acquisition of land has been completed and the construction of the buildings, towers and antenna foundations has been commenced for which an organisation has been set up in Delhi with offices spread over various regions.

Indian National Satellite

The setting up of the above seven stations is a prelude to the much bigger project for establishment of com-

Mr Vaidya is a member (telecom development) in the P&T board.

munication by satellite at 28 more stations to be covered in the Indian National Satellite (INSAT) Scheme.

A geo-stationary satellite can be restricted to cover entire India with a suitable antenna beamwidth. This satellite will have to be placed above the equator and will be fixed with respect to a point on the surface of earth during its rotation. The stations would be at important switching centres like Bombay, Calcutta, Jaipur, Jullundur, Srinagar, Shillong etc and remote areas like Itanagar, Imphal, Agartala, Bhuj, Minicoy etc.

This project known as Indian Satellite Communication—INSAT—Project covering installation of 28 stations and expansion of the 7 earth stations of Intelsat Scheme at an estimated cost of Rs 17.5 million has been approved by the Government of India.

The Indian National Satellite has been specially designed and is scheduled to be launched in early 1981. This satellite, besides providing telecommunication services, will also include equipment for collection of meteorological data and its distribution over the entire Indian sub-continent. This satellite will also have an in - built facility for direct TV broadcast.

Delhi Earth Station

The Delhi Earth Station is going to be the biggest of all the 35 stations ultimately planned. This earth station will act as a control and monitoring station for all the 35 stations as well as the satellite with the help of additional equipment. Further, mobile and air transport units for establishing emergency communication will also be available at this station. About 2000 speech circuits will be available from Delhi via satellite to various other stations. This station, after careful map study, computer analysis, and interference calculations has been located at a site 3 kms away from Sikandrabad (UP) on Delhi-Bulandshahr road.

It will not be out of place to briefly mention here the number of circuits available at other important switching centres also. Bombay and Calcutta will have about 1400 speech circuits, Madras about 1000 speech circuits and other switching centres will have on an average of 200 speech circuits to meet the requirements of the mid-1980's. Adequate circuits depending on traffic requirements will be terminated at the earth stations located in remote areas.

The 28 earth stations covered under 'Insat', include six mobile earth stations for emergency purposes. Two such mobile stations can be transported by air and four by road at short notice. The air mobile units can be used for areas affected by cyclones, floods, earthquakes etc where surface communications are disrupted, while the road mobile units can be used to cover religious fairs, sports events or events of national importance. Thus, this remarkable capability of satellite communication can be exploited to serve short-term telecom needs in the country with ease and economy.

Whereas the radio equipments and antenna subsystems of the seven earth stations covered under 'Intelsat' are being imported, it is proposed to progressively manufacture the equipment for 28 'Insat'earth stations indigenously. Already the power plants, batteries, engine alternators, multiplexing equipments, tower materials etc are being manufactured indigenously.

Significant Advantages

Satellite communication has opened new vistas of long distance telecommunication systems in India. Being a one-hop system it has very significant advantages over other terrestrial systems like greater reliability, higher order flexibility in routing of circuits, potential of providing telecom services at short notice, immunity from terrestrial disasters, possibility of providing point to multipoint transmission whenever required.

The P&T Department, in order to augment and to provide standby communication facilities for the 1980s, is going in a big way for establishing domestic communication links through the Indian National Satellite. ☐

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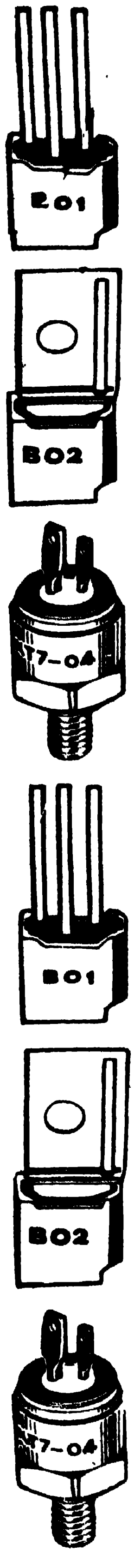

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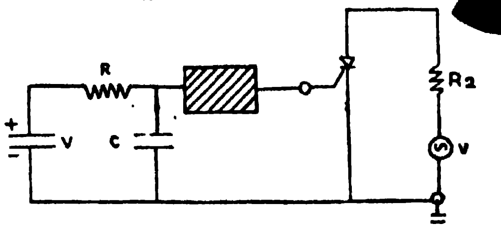

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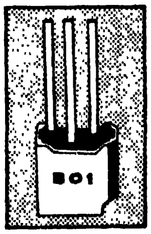

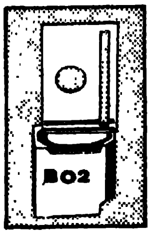

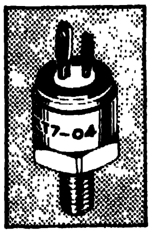

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SPECIAL SUPPLEMENT

Telecommunication Systems—Future Trends

During the past decade there has been rapid proliferation of techniques and technology in the field of telecommunications. This has been the result of, primarily, research work in materials technology, components technology and of processes evolved for making miniaturised circuits, both analogue and digital.

Keeping pace with the improvement in techniques and technology are the industrial engineers who have also evolved novel methods of transferring technology from 'bench' to 'floor,' thereby drastically reducing time and money involvement. Whereas a reduction in costs has been possible due to mass production of components, assemblies and sub-systems, advancements in telecommunication systems are also the consequence of ever-increasing needs of managers, executives, engineers, entrepreneurs and organisations to which they belong.

History

Human beings have been trying to communicate with each other for thousands of years. While they have evolved various methods of doing so, two requirements which have stayed common throughout the history of telecommunications are the requirements of intelligibility and speed of communication.

Since the advent of the telephone, there has been an ever-increasing stress on man's capability to increase his capacity to speed up the decision-making process. Correct decisions come from correct and adequate data received. Telecommunication systems all over the world are being designed and oriented to achieve this result.

Present telecommunication systems

One widely used telecommunications network was fielded by a leading firm in the USA for worldwide telecommunications between their sales offices in USA, Europe, Central and South America and across the Pacific Ocean in Palo Alto. This network has been named COMSYS. The authorities claim to have achieved low-cost, error-free transmissions which can handle a 10,000 words message in one minute and cost a mere £40 as against 16 hours time and £800 for a normal teleprinter circuit. This is a phenomenal reduction in time and cost. The main factors that have contributed to this achievement are:

1. Special modems with 0-4800 bps are used for short haul communications using wires.
2. Duplex modems are used on dial-up circuits.
3. Computer terminals are used on circuits based on point-to-point communications.
4. For multipoint circuits, computer-based multiple terminals are used; of course with remote terminal access.
5. Frequency division multiplexing on voice grade lines are used; this gives a large number of channels.
6. On certain selected high quality channels time division multiplexing is used; this increases reliability as well as the number of channels.

The importance of telecommunications is depicted here. The head of a top executive which has eyes, ears, mouth and brain is replaced by a telephone of tomorrow.

An idea of the point-to-point system can be obtained from Fig. 1.

Analysis of COMSYS

COMSYS is basically a computer-based network which serves the needs of the management in more than one way, namely:

1. Data communications are provided between geographically separate locations.
2. Source data entry, editing, local data storage and retrieval is provided via a CRT terminal.
3. Remote job entry facility to a large computer system is provided.

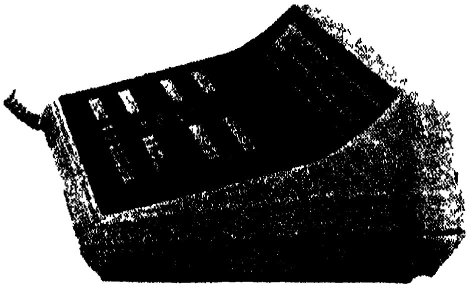
From the commercial angle three factors are responsible for cost reduction on calls connected through this system:

1. Standard dial-up phone lines are used and no special lines are hired for communication within the country.
2. Communication with outlying areas is in batch

mode as against on-line mode for which lines are leased twice a day only.

3. The outstations, which number 2026, use error correction and data compression, thereby minimising connection time.

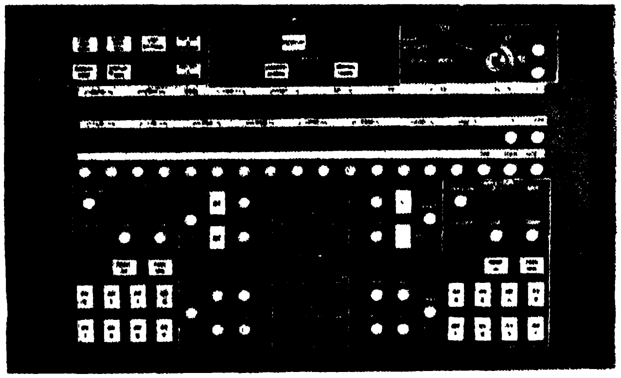
The COMSYS uses a wide variety of transmission channels ranging from the overhead wires for nearby communications to satellite systems for trans-pacific communications. Presently, the COMSYS is being used for marketing, accounting, employee information and administration on a world-wide net.



Company exchange of the future

Telecommunication systems in the near future

A real-time telecommunication system in the near future entails use of spurt transmission techniques to reduce circuit time. A dynamic time sharing would be possible in such cases, and sharing of transmission facilities would allow a more efficient utilisation of infra-facilities, resulting in cost reduction. One such system is popularly known as 'packet-switched voice and data network.' This has applications of a combined transmission system for voice and data which will have multifarious applications like multi-destination despatching, conferencing facility, computer-generated voice response, automatic speaker authentication and recognition.



Computerised telephone exchanges; right for today—ready for tomorrow.

To make a layman understand the principles behind packet-switched voice and data networks, it is necessary to define the principles involved as well as identify major areas and building blocks of such a system.

A voice conversation may last one to ten minutes on an average. The conversation has gaps during which the circuit remains unutilised. These gaps may be of the duration of a few milliseconds. Also, while two persons are conversing, usually only one of them talks at a time. Therefore, circuit time which remains unutilised is: (a) between words and sentences, and (b) full one way time in the direction speech signals are not being transmitted, during a conversation.

The first step to achieving success in such a system is to digitise speech and reduce the bandwidth of each channel to the barest minimum. During peak hours a certain degradation in speech may have to be tolerated due to reduction in sampling time. Many variations of bandwidth parameters are possible for full utilisation of channel capacity.

When a subscriber lifts the handset of a telephone and starts dialling the number of the distant subscriber, a channel is not made available straightaway but a source switch analyses the demand and gets ready for packetisation. On receipt of the digitised speech it performs the packetisation function and combines the speech with data for transmission. The reverse happens at the receiver end. Fig. 2 illustrates the concept of packetisation.

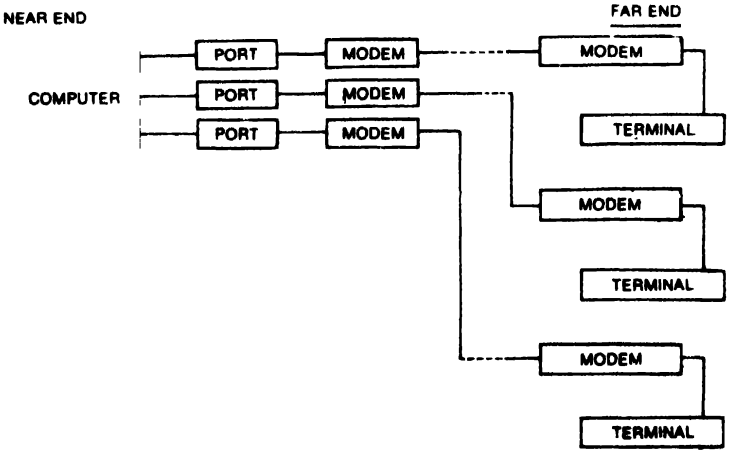


Fig. 1: A point-to-point communications network using computer terminals.

An important sub-system of the chain is the adaptive delay buffer. The buffer compensates for the delays in arrival of the packets and averts the discontinuity in reconstruction so that there is no disruption in speech.

The bit error and loss of intelligibility can occur in a system of this nature. Particularly, if the 'pitch' of a conversation is not received correctly, it may introduce distortion in speech. To overcome error and loss, forward-error correction is proposed to be employed for selective speech parameters.

However, complete loss of a packet may also occur in transit. This may be due to heavy noise or even misrouting of the packet. The loss of a packet also results in breaks in speech, creating further problems. This problem is being investigated by engineers and scientists, and they think that a robust silence detection technique may perhaps be the answer to this problem.

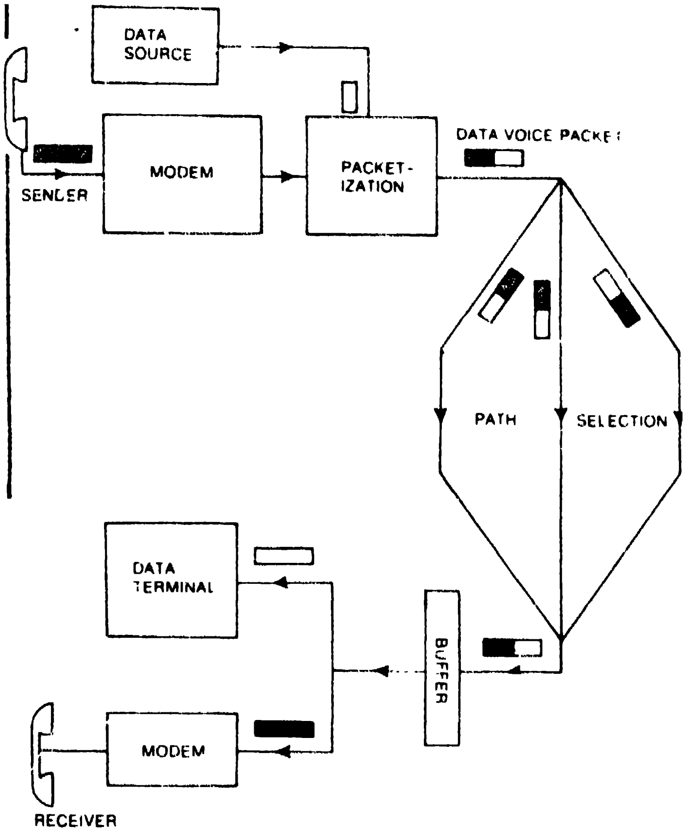


Fig. 2: **Packetisation of speech and data.**

Requirements of future telecommunication systems

There are three areas in which the expansion of telecommunication systems can be visualised at present. These are:

1. Increased volume of traffic.
2. Reduction in time of clearance.
3. Improvements in techniques including coding.

The expansion of telephone traffic in Canada can be cited as an example to illustrate the above points. During the last decade, the number of telephones in Canada has risen from 4.5 million to 10 million. Telephone calls have risen from $6X10^9$ to $33X10^9$ calls per year. Although the telephone network has tripled in size, it has not been able to keep pace with requirements.

There has been a 10-time reduction in the speed of connecting calls, but facilities like the picture-phone, trans-oceanic dialling and facsimile have been commercialised. Minicomputers have automated many manual systems. However, the time for connecting calls is still very high and beyond the users' comprehension. Lastly, the techniques of transmission are far below the requirement. Picture-phone, data transmission and teleprinter services need further improvements.

Basically, telecommunication systems in the future will have to be designed for covering vast areas, throughout the world, with no degradation in service. A detailed analysis of the facilities likely to be provided to users of tomorrow has been carried out by leading systems engineers the world over. A gist of this analysis can be listed as under:

Worldwide Telecommunication Services in the Future

1. Machine to machine transmissions in both directions at variable data transfer rate.
2. Two-way audio and audio-visual person-to-person conversation with private and conference calling facility.
3. Transmission of alphanumeric and graphic material; and facsimile, data television entertainment and broadcast facility.
4. Access to and control of computers, access to data for renewal, transfer and retrieval—all from remote terminals.

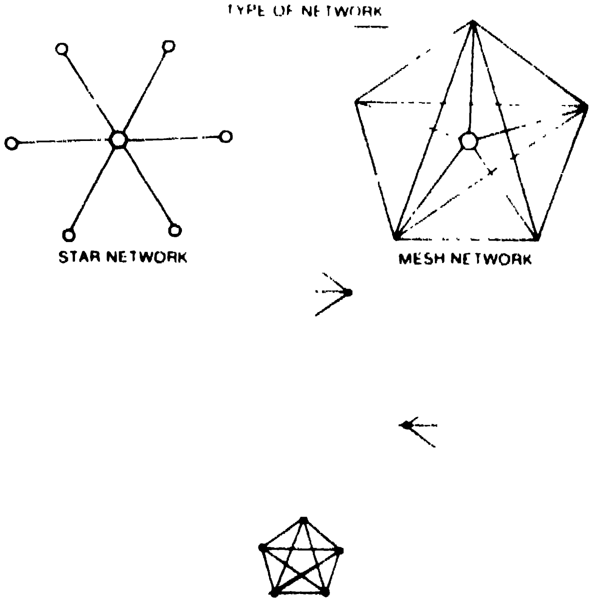


Fig. 3: **Telecommunication network.**

5. Storage of messages coding of language and speaker recognition.
6. Automatic accounting of messages and groups.
7. Automatic addressing and programmed priority entry and exits.

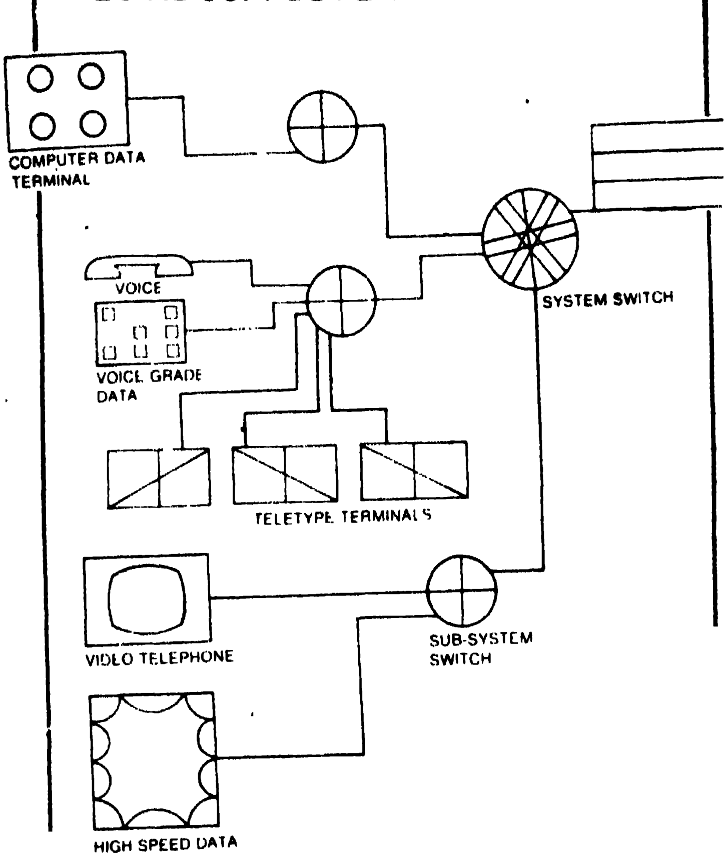


Fig. 4: Telecommunication system of the future (an artist's view)

8. Automatic selection and addressing of transmission paths.
9. Timed calls and despatch of photo information including displays at each end.
10. Complete compatibility between calling and called subscriber systems, minimising losses at terminals and en route.

It is envisaged that future telecommunication networks will be based on fast switching for selective routing on multiple systems. This implies that a specific type of traffic, such as speech, visual information, low and high speed data etc are switched over the best possible routes selected out of the ones available. These routes may be functionally discrete but physically integrated. The control centre in each case is a switch for selection of the discrete channel. Both economy and versatility are achieved by the switch. Here two types of networks can be visualised, depending on the amount of traffic between various points. These are the star and mesh networks. A third type could be a hybrid combination of both these networks (see Fig. 3)

A closer look at the switching

The switching systems can be classified into those with manual and those with automatic operation. The manual system is a relic of the past and the automatic system with manual intervention, where necessary, is being used in most places at present. The next step is to change over to the automated computer controlled system. This involves digitisation on a large scale for which pulse code modulation and time division multiplexing is necessary. The basic requirement in such techniques is a high speed switch with inherent reliability and self-correction mechanisms. The most modern switch envisaged in this field is the 'stored programmable control' giving facilities of a modern computer adopted as a switch. The concept of a computer controlled switch supports the view that every type of telecommunication system, may it be land lines, coaxial systems, optical cables, radio relay or even satellite systems, should be accessible and penetrable.

A future switching system envisages the use of subscriber cards with a personal code. A slot on the control panel of the terminal in the subscriber's office will receive this card for interrogation and entry of data to connect him to the desired service. The control panel will provide facilities for viewing the far end subscriber and coding the conversation, if required, by pressing a button. Recording at either end will also be possible through magnetic recorders. An artist's view of such a future telecommunication system is given in Fig. 4.

Conclusion

The normal hierarchical networks which exist in many parts of the world are now being changed to more modern systems. Technical factors influencing this change are—shift to digital techniques of transmission and automatic switching to meet the needs of speed and cost. Therefore, with the evolution of these concepts, scientists and economists are faced with the problem of updating capabilities of existing systems. They foresee large scale wastage in hardware and ancillary services if such a change is expedited. However, in a highly developed country such costs are offset by quick returns generated due to greater efficiency.

A lot is being said and written about future telecommunication systems. The main areas of attack are time reduction, service improvement and cost reduction. Whereas time reduction is entirely technical, the remaining two are partly administrative. An idea of what future telecommunications systems will be like has been given in this article. How things shape in the future will, of course, depend primarily on the breakthroughs in the use of digitisation and the switching technique. ☐

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SATELLITE COMMUNICATION IN INDIA

O.P.N. Calla

The activity in the field of satellite communication technology in India started in 1965 when the first Experimental Satellite Communication Earth Station (ESCES) project was initiated. One looks back and sees that about 15 years have passed since the country got initiated in the field of satellite communication technology. We have come a long way and can boast that the various systems and subsystems we had to import in 1965 can now be provided almost all indigenously. Table I gives the indication of the same.

During this time efforts have been made to indigenise all components required for earth stations and these have been successfully used in the various earth stations set up for Satellite Instructional Television Experiment (SITE) and Satellite Telecommunications Experiments Project (STEP). Table II gives the earth station specifications which were used in STEP

A new dimension was added to the earth station technology in India when a transportable communication terminal was built for experiments with the Symphonie satellite. In contrast to the earth stations at Ahmedabad, Delhi and Madras, the transportable terminals possess the additional flexibility of moving them to distant experimental sites. The Transportable Remote Area Communication Terminal (TRACT) is primarily an earth station, mounted on a truck with antenna assembly. The antenna reflector will be dismantled for transportation and will be assembled at the site every time TRACT moves over to another site. Associated with TRACT, there is a service vehicle which carries the maintenance test equipment, essential spares and personal effects of the crew. This service vehicle also tows a 32kVA diesel generator set mounted on a trailer.

TRACT could originate TV programmes from remote locations and from places where important events took place. It also offers thin route telephone facility to major earth stations on a Single Channel Per Carrier (SCPC) basis. For this purpose, TRACT will be connected to the local telephone exchange.

Another terminal which is jeep mounted and air transportable is the Emergency Communication Terminal (ECT). It is a miniaturised and ruggedised system with a 3-metre reflector which could be easily dismantled, packed and loaded into a trailer.

Mr Calla is Chairman, Communications Area and Project Director, STEP, Space Applications Centre, Ahmedabad. The views expressed in this paper are his personal views and not of the organisation.

TABLE I

Background of Earth Station Technology

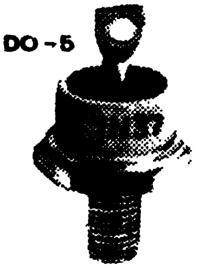
Major sub-systems	*1965 (ESCES)*	*1971 (Vikram earth station, Arvi)*	*1975 (SITE)*	*1977 (STEP)*
Antenna	Imported	Indigenous	Indigenous	Indigenous
Feed	Imported	Imported	Indigenous	Indigenous
Tracking system	Imported	Imported	Indigenous	Indigenous
Servo & Drive system	Imported	Indigenous	Indigenous	Indigenous
6 GHz HPA	Imported	Imported	Indigenous	Indigenous
4 GHz Parametric amplifier	Imported	Imported	Imported	Imported
Low noise amplifier	Not reqd	Not reqd.	Indigenous	Indigenous
C-band upconverters	Imported	Imported	Indigenous	Indigenous
C-band/UHF down-converters	Imported	Imported	Indigenous	Indigenous
Modulator & Demodulator	Imported	Imported	Indigenous	Indigenous
Multiplex Eqpt	Indigenous	Indigenous	Not reqd	—
System Engg and installation	Imported	Indigenous	Indigenous	Indigenous
Power supply	Indigenous	Indigenous	Indigenous	Indigenous
SCPC baseband	—	—	—	Indigenous

IT (AV)	PIV	Series	Type
6	50 1600	1N 1341B	Normal
12	50-1600	1N 1199A	
16	50 1600	1N 3615	
6	50-1000	1N 3879	Fast● Recovery
12	50 1000	1N 3889	

DO-4

IT (AV)	PIV	Series	Type
25	50-1600	1N 2154	Normal
35	50-1800	1N 1183	
40	50-1600	1N 1183A	
60	50-1800	SR 6000	
70	50 1600	SR 7000	
20	50 1000	1N 3899	Fast● Recover
30	50-1000	1N 3909	

DO-5



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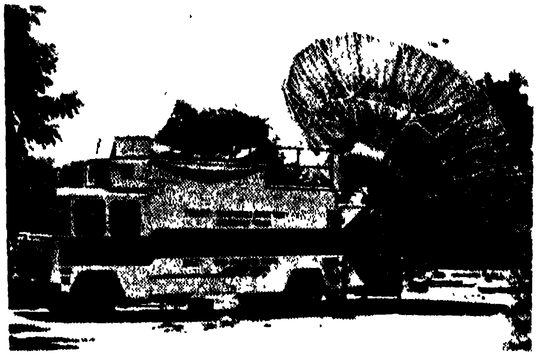

Transportable Remote Area Communication Terminal (TRACT).

A special shelter that is fitted on a standard jeep, houses the electronic equipments comprising the SCPC Modem, 20W power amplifier, up and down converters etc. The terminal has been so engineered that it could operate from standard car batteries which are rechargeable in field using a small petrol driven generating set. The terminal has been utilised for providing emergency communication facility required for flooded or cyclone hit areas.

For the planned domestic satellite communication systems, it is clear that for the utilisation of Intelsat-IV transponders most of the subsystems for the earth stations are being imported as of today. It is hoped that the remaining earth stations required for INSAT will not be imported. Thus it is desirable that in a country like ours efforts are made to indigenise the production of the earth stations at the earliest.

It may be desirable that some of the state electronics corporations which are involved in the manufacturing of electronic items could be geared for productionising the earth station equipments. For doing this a consortium of state electronics corporations could be formed based upon the expertise available with each electronics corporation. The suggestion is that an overall system design group be created which in turn will draw up the specifications and the subsystem specifications for the earth stations required. One of the state electronics corporations could be assigned the responsibility for the integration and installation of the earth stations and all the subsystems could be subcontracted based upon the expertise available in each electronics corporation. The system design group will monitor overall scheduling of the projects and with equitable distribution of the work in various state electronics corporations, the requirement of the earth stations of the country could be met.

The future of satellite communication requires various technical aspects to be looked into:

One aspect is the use of higher frequencies for satellite communication. The utilisation of 11/14GHz band for satellite communication is maturing world-over and one may have to think of utilising this band in our context in near future. What is required for this is that the propagation phenomena be studied and its aspects properly looked into. This will require the propagation studies to be conducted in this frequency band and also conduct some communication experiments using the ground station hardware and possibly using Intelsat-V transponder which will have 11/14 GHz available for experimentation.

Second aspect in the future trend will be the use of digital communication techniques for satellite communication. The trends will be to go for higher and higher data rates and use of Time Division Multiple Access (TDMA).

For thin route traffic the Single Channel Per Carrier (SCPC) equipment will find use with mobile transportable system for rural telecommunication purposes. The use of mobile terminals shown in the photograph will be of great utility for future domestic satellite communication system.

Table-II

	Ahmedabad Earth Station	*Delhi Earth Station*	*Madras Earth Station*
Antenna diameter	14 M	10.7 M	10.7 M
Power	3 KW	3 KW	3 KW
G/T	29 dB/°k	28.5 dB/°k	28.5 dB/°k
Capabilities	TV transmit-receive Trunk telephony Thin route telephony Radio networking	TV transmit-receive Trunk telephony Thin route telephony Radio networking	TV transmit-receive Trunk telephony Radio networking
Operational since	1967	1975	1977

	TRACT	*ECT*
Antenna diameter	6.1 M/4.5 M	3 M
Power	3 KW, 400 W	20 W
G/T	24 dB/°k	17.5 dB/°k
Capabilities	TV transmit-receive Thin route telephony Radio networking	Thin route telephony Radio networking
Operational since	1977	1977

In conclusion, I would like to say that the foresight with which Dr Vikram A. Sarabhai initiated the ESCES project in 1965 was for becoming self-sufficient in the development of indigenous ground station hardware so that for the domestic satellite communication systems all the hardware will be available from within the country. I must say that still there is time and with whole-hearted effort one can try to see that the dream of the great man is fulfilled. □

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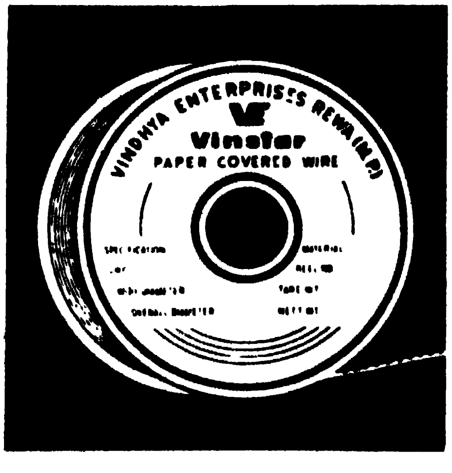

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SOLDERING TECHNIQUES (Part 2)

Devendra K. Soni

Hand soldering

Even today, most solder joints are made by using either a soldering iron or a soldering gun. Besides being the simplest among all the techniques, this method gives the operator maximum control over the finished joints in terms of the heat applied and the amount of solder permitted to flow. Individual attention can be given to each joint without interfering or disturbing the adjacent points. Also, the application of heat is localised to a very small area.

A soldering iron consists of a high resistance heating element and a relatively massive tip. The element is slowly heated to soldering temperature and the temperature is maintained at this level. If the tip is kept clean and well tinned, it permits the maximum amount of heat to be conducted from the soldering tip to the point at which the soldered connection is being made.

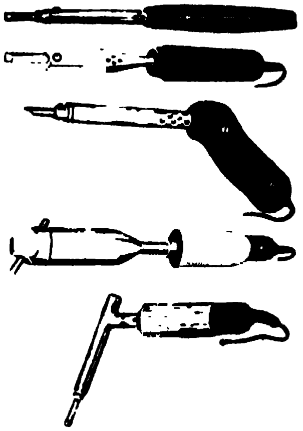


Fig. 4: Various types of soldering irons

The usual practice is to tin only that portion of the tip which is actually used during soldering. The oxidation coating on the rest of the tip then acts as a heat insulator, and reduces the risk of heat being applied to some adjacent components which the tip may touch while soldering.

A commonly-used general-purpose soldering iron tip is made of a pure copper bar which is iron clad or nickel plated to resist corrosion. The tip should not be filed, since this will destroy the plating and thus shorten the tip life. To clean such tips, use of a tip cleaner (or a fine sand paper) is recommended. After the tip has been cleaned, it should be retinned.

Fig. 4 shows soldering irons of different shapes and ratings whereas Fig. 5 shows various types of tips used for soldering.

A soldering gun (Fig. 6) comprises a step-down transformer with a thick-wire secondary winding for high current. When operated by a trigger switch, the gun's relatively low-resistance tip reaches the soldering temperature rapidly. The small tip of the soldering gun permits concentration of heat at the solder joints. This prevents damage to surrounding components from excessive heat and also saves considerable power as the gun has a very low duty cycle, i. e. 'on' time to 'off' time ratio.

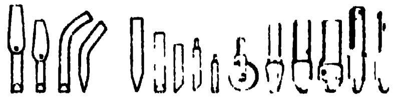


Fig. 5: Various types of soldering iron bits

However, as the gun comprises a built-in transformer, it causes working fatigue if held continuously (as in line production work) because of its heavy weight. The gun is therefore best suited for those engaged in repair work.

Dip soldering

This technique is usually employed in places where soldering must be done at a rapid pace, such as in mass production work. The pre-tinned components are mounted as required on a printed circuit card, or a number of solder joints are made simultaneously and uniformly on a non-conductor base, and mechanically secured by one means or the other. The flux, normally in a liquid form, is then applied to the points to be soldered and allowed to dry. This assembly or printed circuit card is then simply dipped slowly into a solder pot to a depth just sufficient to allow solder to flow freely into all the connection points and withdrawn from the solder after a short period (Fig. 7). The advantage of this type of soldering is that gravity and temperature control the amount of extra solder adhering to the assembly. Solder with the eutectic 63:37 or 60:40 ratio is the best for dip soldering because it has either no pasty state or a very brief pasty state temperature range.

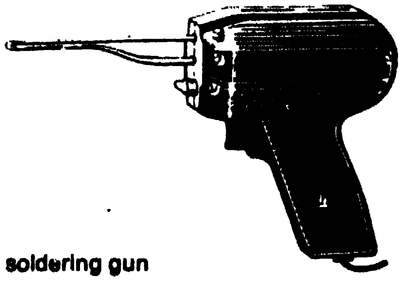


Fig. 6: A soldering gun

Wave soldering

In wave soldering (Fig. 8), a continuous molten solder is

Mr Soni belongs to the electrical engineering department of L. D. College of Engineering, Ahmedabad. The first part of this article was published in the April 1979 issue.

pumped up to the level of the printed circuit board in the form of a fountain, or a molten solder is pumped into the spout, forming a head of solder through which the work can be passed. This method has the following advantages over the dip soldering method:

1. The dynamic movement of the solder across the surface to be wetted decreases the soldering time by many orders of magnitude.

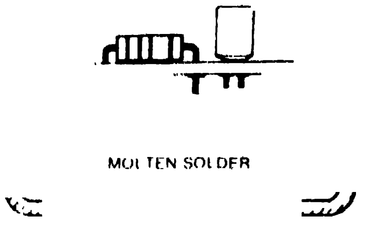


Fig. 7: Schematic of dip-soldering bath

2. The heat distortion, i. e. buckling etc, to the work is minimised to practically much within the tolerance level.
3. All flux and flux residues which are wiped off the work and would normally stay on top of the solder baths are carried down with the wave into the special reservoir where they do not come in contact with any future work.
4. The molten solder being continuously pumped, it is easy to maintain the temperature practically constant. Thus the temperature of the molten solder touching the work is always uniform and can easily be controlled and maintained.

This method is recommended for large quantities of work with a high percentage of reproducible and reliable solder joints.

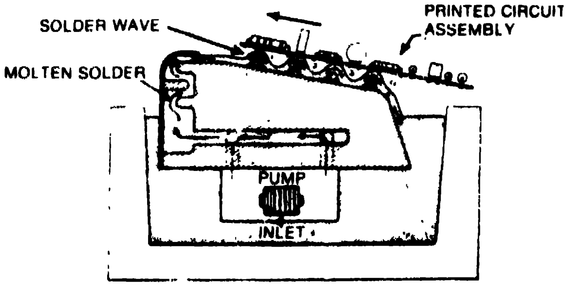


Fig. 8: Schematic showing wave soldering process. Wave nos. 2, 3 and 4 are solder waves, whereas no. 1 removes icicles—if any.

Induction soldering

In this method, the heat required to produce solder joint is generated within the workpiece by exposing the points to be soldered to the electromagnetic field produced by a high frequency current. Eddy currents induced in the metals heat them rapidly.

Resistance soldering

When a large current is passed through a high resistance material, a large amount of thermal energy is generated. This heat is instantaneous in nature and can be highly localised, which is suitable for soldering. Generally the equipment comprises a variable current source and a set of high resistance contacts. This method should not be used where current sensitive components are involved. It is also possible to get one electrode system, the job being grounded.

Properly controlled resistance soldering is a very reliable method of soldering. It can be easily automated and is also an economic way of soldering. The heat can be localised because of fast heating and rapid cooling. It is thus very useful for hermetic sealing of components' caps etc.

Ultrasonic soldering

The term 'ultrasonic' does not refer to the mode of pre-heating for soldering. Rather it refers to a technique used to facilitate soldering without any appreciable changes in the temperature of the assembly to be soldered. Once the system has been brought to the soldering temperature, high frequency (ultrasonic) waves are generated in the molten solder. These ultrasonic waves cause an erosion of the surfaces, whereby foreign particles as well as tarnish layers are physically removed and the bare metal underneath is exposed. As a result, the solder is able to wet the surfaces adequately without the need of any flux. This technique is thus very useful whenever use of flux is not feasible. The method is, however, not very common because of its prohibitive cost.

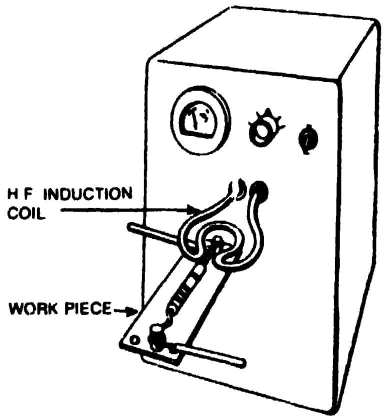


Fig. 9: Schematic representation of a high-frequency induction soldering unit

Crimped connections

This is a mechanical method of connecting the components. As can be seen, it is not suitable for printed circuit board wiring, but is useful for wire extension or connecting it with terminals, lugs etc (see Figs 10, 11 and 12).

It should be remembered that a good mechanical joint should produce good metal-to-metal contact with the surfaces free from tarnish. High pressure between the conductors is necessary to provide gastight areas capable of withstanding weather and corrosion. The area of contact must be greater than the cross-section area of the conductors involved to avoid resistance and heating.

SOLDERING SEMICONDUCTOR COMPONENTS

When soldering the lead of a semiconductor component such as a diode, transistor, thermister, LDR etc, it is desirable to use a light-duty (25W or less) soldering iron. If a larger rated iron is used, excessive heat may be conducted into the component, causing a permanent damage. The following points are worth noting at this stage:

Heat sink

When soldering or de-soldering the leads of a semiconductor component, a heat sink should always be used to absorb heat that may otherwise be conducted into the component. A very convenient heat sink can easily be made by soldering a small sheet of copper or brass to a 'crocodile clip, as shown in Fig. 13. In use, the clip is attached to the lead of the component at some point between the component and the terminal to which the lead is being soldered. Use of a long-nose plier to grasp a bare portion of the semiconductor's lead near the terminal to which the wire is being soldered also serves the purpose.

Copper wire tip

A medium or heavy duty soldering iron can be converted into a satisfactory soldering tool by wrapping a copper wire (14 to 16 gauge) to work as a tip, as shown in Fig. 14. To enable the maximum amount of heat conduction from the parent tip to the working tip, the parent tip should be thoroughly cleaned and the wire should be tinned before wrapping.

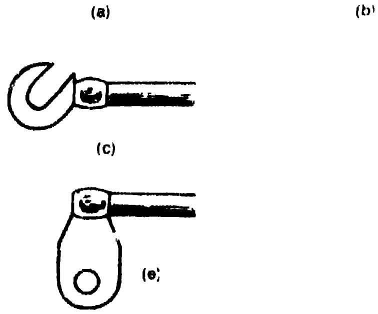


Fig. 10: Basic terminal styles or solderless crimped terminal styles: (a) ring tongue; (b) spade tongue; (c) hook tongue; (d) flanged spade tongue; and (e) flag tongue

Voltage leakage

Some semiconductor components, ICs and LSIs are very sensitive to voltage, especially the MOS types. Let us consider a MOSFET, in which a very thin layer of SiO2 forms the dielectric between gate and channel. This layer has extremely low leakage. Hence a static charge can build up and become high enough to cause a breakdown of the oxide layer. Some transistors are so sensitive in this respect that they are shipped to users with their leads wrapped in a metal foil to keep potentials between leads nil. Same is the case with MOS ICs and MOS LSIs.

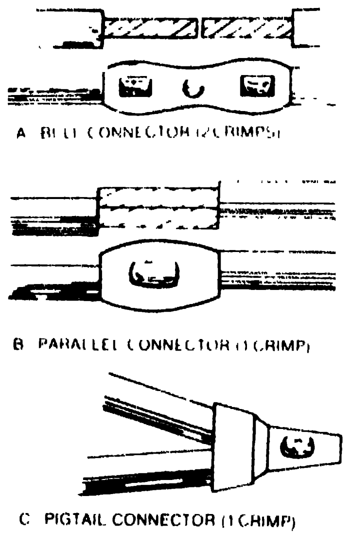

A BUTT CONNECTOR (2 CRIMPS)
B PARALLEL CONNECTOR (1 CRIMP)
C PIGTAIL CONNECTOR (1 CRIMP)

Fig 11: Three methods of splicing wires with crimping tool and connectors

The possibilities of an electric charge being transferred from the soldering iron to a semiconductor cannot be ignored for the following reasons:

1. The heating element in soldering iron is a coil of wire. When AC voltages are applied to it, a varying magnetic flux may be developed which may get induced by transformer action in a nearby closed electrical circuit. Thus, if the soldering iron's coil happens to be sufficiently near a closed circuit including a low-impedance transistor, enough currents can be induced to damage the transistor.
2. Mica or ceramic normally used as an insulator between the heating coil and the metal parts of the soldering iron are good dielectrics for a capacitor. Some AC voltage can be transferred to external circuits through the capacitance effect of the insulator as a dielectric and the coil as a voltage source.
3. The insulation material, mica, is not a perfect insulator. It may have a very high leakage resistance of several hundred megohms. But the MOS components to be soldered may have an even greater impedance of several hundred or more megohms. In that case the components, if soldered without any precaution, can be exposed to nearly full voltage of the coil.

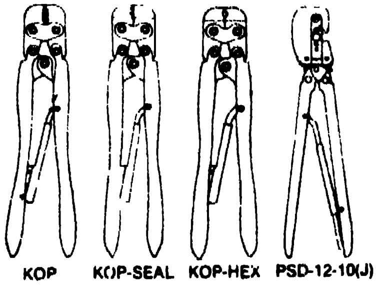


Fig. 12: Hand crimping tool/tools

The solution to these problems lies in the use of a low voltage (12V or 24V) iron using an isolating transformer with a transient suppressor. This brings the maximum potential well below the breakdown potential of the oxide layer in the MOS components.

Post-soldering treatment

To be chemically effective, every flux must be corrosive to some degree. Otherwise it will be incapable of removing tarnish from the surfaces to be cleaned. Only the residues of water-white rosin or properly treated activated rosins can be left on the assembly under special conditions. It is therefore safe to say that the best practice for good soldering includes a flux removal operation.

Many organic solvents like acetone, amyl acetate, carbon tetrachloride, toluene and xylene can be used to remove the rosin flux residues. However, while using these chemicals proper care must be taken as most of the chemicals are easily flammable and may cause serious irritation to an individual when inhaled or absorbed through the skin. Work should be carried out in a properly ventilated room and workers should be provided with gloves.

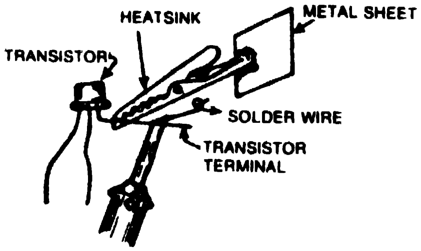


Fig. 13: Crocodile clip can work as heat sink

After treating the soldered assemblies with the flux removing chemicals, they should be further cleaned in either a vapour degreaser or in an ultrasonic cleaning equipment.

In order to prevent formation of corrosion, whatsoever, a protective layer or coating should be applied over the soldered printed circuit card. It may be applied by brushing, spraying or dipping. A layer of varnish or lacquer may very well serve the purpose and at the same time allow repair work in the future. The use of epoxies on the other hand, prohibits future repair work.

Do's and don'ts for soldering

Whether soldering a few connections or thousands, the basic requirements for good soldering remain the same. Following are a few points to be remembered:

1. Select proper soldering iron (25W or less for electronic assembly work).
2. Do not solder unclean or oxidised surfaces.
3. Use only rosin fluxes.
4. Do not depend on a soldered joint to withstand mechanical or physical stresses.
5. Do not touch component connecting leads with bare fingers.

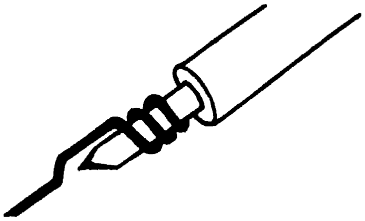
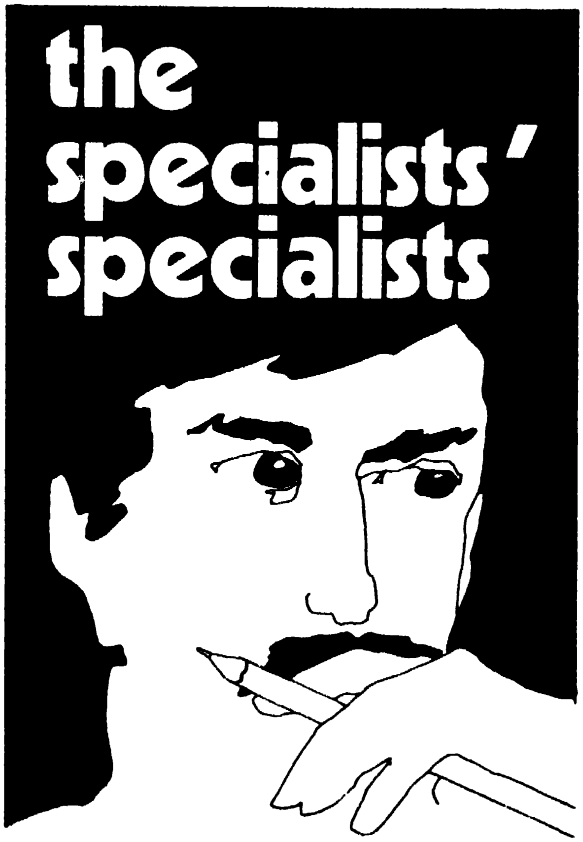


Fig. 14: Extending the tip of a soldering iron using bare copper wire

6. Use heat sinks for soldering resistors with rating up to 1W, capacitors and all semiconductor components.
7. In dip soldering, always use a solder pot or bath wide enough to accommodate work pieces comfortably and deep enough to maintain a uniform temperature throughout.
8. Avoid double dipping printed circuit assemblies.
9. Don't put terminals too close together on a printed circuit board.
10. Do not use solder to hold parts together.
11. Design equipments into easily solderable sub-units.

SOME COMMON SOLDERING DEFECTS

Defect	*Explanation*	*Main reasons*
1. Dry solder	The solder does not adhere well to either of the workpieces; may cause 'noise' voltages in the circuit	1. Poor wetting or solderability 2. Unclean surfaces 3. Insufficient soldering temperature 4. Flux activity not proper 5. Base metal not compatible with solder
2. Intermittent or loose joint	A joint or connection which has fractured or come loose	1. Shaking of either member during soldering (after heat source is removed) 2. Soldering temperature not high enough 3. Non-eutectic solder used 4. Design does not provide sufficient joint strength 5. Excessive copper/ iron in the solder (particularly in wave soldering) leading to a brittle joint
3. Corroded joint	Corrosion on the solder on the terminal	1. Excessive flux activity and consequently flux residual becomes corrosive 2. Environment is corrosive 3. Post-soldering treatment not given
4. Lifting of PCB at the solder point		1. Too high soldering temperature 2. Soldering time too long 3. Defective laminate 4. PCB circuit too narrow in width



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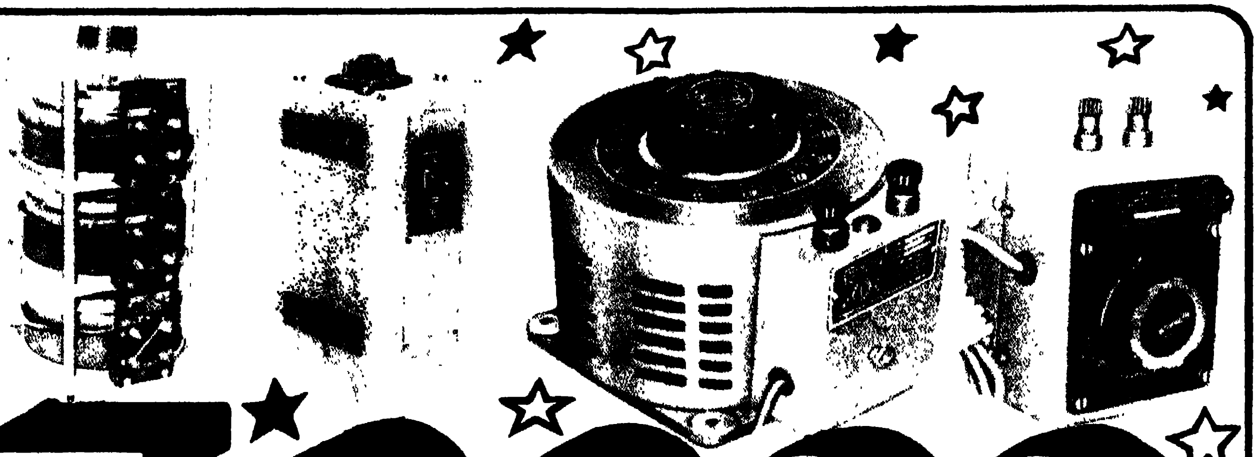

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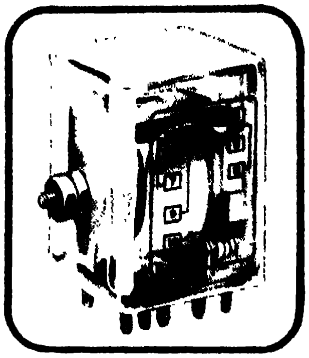

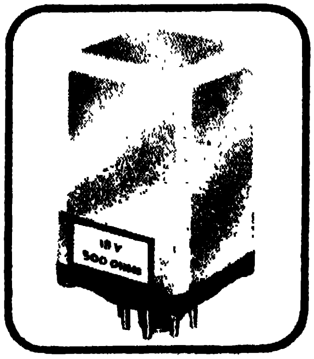

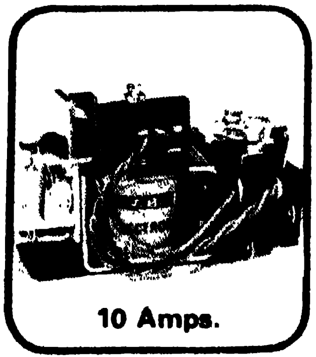

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Make Yourself This FUNCTION GENERATOR Using A Single IC

K. Padmanabhan

The testing of various electronic equipments, including amplifiers and radio receivers, is very much simplified if we have the proper instruments. One such important instrument is the audio frequency generator. A generator which can produce square, triangular and sawtooth waves in addition to the sinusoidal waves is called a 'function generator.'

A function generator is much more useful than an AF generator as it can be of great help in testing a wide variety of electronic equipment. Some commercially available function generators are capable of producing sine, square, ramp and triangular waveforms over a wide frequency range—from as low as 0.001 Hz to 100 kHz.

The circuit given in this article requires an inexpensive IC to which only a few external components need to be added. However, the output voltage swing of the function generator is only 3V, and its frequency range can go up to 50 kHz only. This is not in any way a serious limitation, because a function generator is not generally required to measure beyond this range.

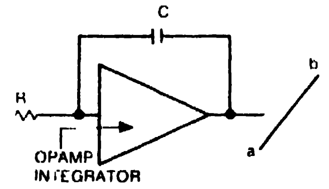

Fig. 1: Integration of a positive voltage

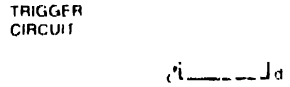

Fig. 2: Trigger circuit changes from positive to negative output

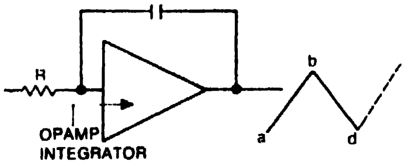

Fig. 3: Integration of negative voltage

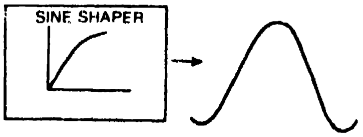

Fig. 4: Sine shaping

The total cost of the components used in this circuit hardly exceeds Rs 100. The components are available locally, including the IC. The performance of the circuit has been tested a number of times and the circuit has proved itself quite reliable. Following the instructions in this article, anyone should be able to construct and use it without much difficulty.

Principle of operation

The general principle of all function generators is to first produce a triangular wave and then shape it into a sine wave. This method is thus different from the older R-C or L-C oscillator type AF signal generators, which produce the sine wave directly by oscillation. The shape of a sinusoidal wave obtained from a triangular wave is, however, not as perfect as what we get from the oscillator type instruments—a point which must be borne in mind.

Fig. 1 shows the schematic of an operational amplifier connected as an integrator, with a capacitor between output and input terminals. If a positive DC voltage is applied at the input, the capacitor charges up linearly and we get a straight-line output voltage (a-b).

If we connect a suitable trigger circuit (Fig. 2) at the output of this straight-line voltage, and if it triggers at point 'b', then its voltage output will change sign from a positive voltage to a negative voltage, from point 'b' to 'c'.

Now, consider Fig. 3. Here, by suitable interconnecting arrangement, the negative voltage 'c' of Fig. 2 is connected to the input of the opamp integrator. Now the integrator capacitor starts discharging in the straight line manner downward, from 'b' to 'd'. So, one wave of the triangle has been generated.

Once again the trigger circuit starts to switch over from negative to positive after reaching point 'd'. This positive voltage, when again applied to the integrator, generates the next positive-going straight line (d-e).

In this way, a continuous triangular wave is generated. The frequency of this wave is decided by the values of the resistor and the capacitor, and by the threshold values of

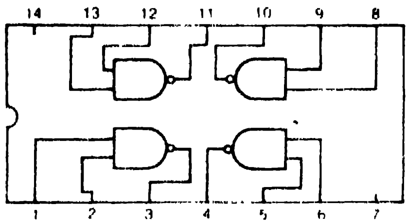

Fig. 5: Pin numbers and internal schematic of IC 4011A

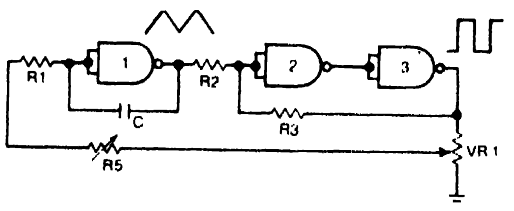

Fig. 6: The basic circuit

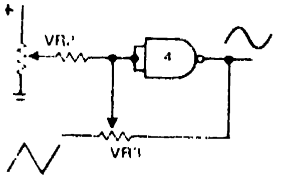

Fig. 7: Generating the sine curve

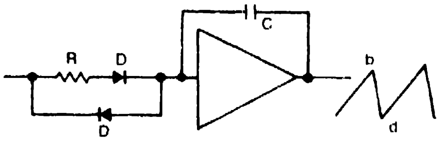

Fig. 8: Generating a sawtooth curve

the trigger circuit

To get a sine wave from the triangular wave, the general method is to use a field effect transistor. This transistor has its V-I characteristic in the shape of a sine curve below is 'pinch-off voltage.' As shown in Fig. 4, the triangular input wave gets flat-topped and flat-bottomed because of the characteristic curve of the FET. In fact, the FET must be biased properly if it has to do its job properly in shaping both the top and bottom of the triangular wave.

The generation of a sawtooth waveform is simple. A sawtooth is just a triangle with its second edge falling down steeply. So, in place of the resistor in the integrator, if we bypass the resistor for the negative half by a set of diodes (see Fig. 8), we get a faster fall for the part b-d.

Circuit description

The circuit uses only one IC which performs the functions of an integrator, trigger circuit as well as sine shaper. The IC used is the CMOS type CD4011AE, which is a 'quad two input NAND gate,' a digital IC, equivalent functionally to the TTL type 7400. This IC comprises four gates, each of which has two inputs and one output. The pin numbers of this IC and its internal schematic are shown in Fig. 5. However the gates of the IC are not used in this circuit conventionally as digital gates, but somewhat in the manner of linear amplifier circuits.

It can be tested and shown that each of these gates can be used as an operational amplifier with a gain of over 100. Thus, in order to connect the first gate as integrator, we have a capacitor C and a resistor R1. Gates 2 and 3 form a trigger circuit which has an upper trigger level of about 3.5 volt and a lower level ot 0.5 volt. So, the capacitor voltage swings between these values in generating a triangular wave. The resistor R5 varies the frequency in a continuous manner. 'VR1' is required to adjust the symmetry of the triangle.

Now, in Fig. 6, the three gates of the IC are used. The fourth gate is used for generating the sine wave from the triangular wave, as shown in Fig. 7. 'VR2' adjusts the bias of the MOS FETs in the gate input and 'VR3' adjusts the gain so that symmetry and shape of the wave can be adjusted as near as possible to a sine curve. An oscilloscope is required for this adjustment.

The complete circuit diagram is shown in Fig. 9. This includes the switch for the selection of the capacitor C to give the five ranges of frequencies, the 'fine' frequency control using potentiometer (R5 for Fig. 6) and the diode selecting switch S2 for selecting either triangular, sinusoidal, square or sawtooth waveforms. The circuit also contains three transistors which are emitter-followers to give a low impedance output. The outputs are 3V peak-to-peak for triangular and 5V peak-to-peak for square and sinusoidal waves. An external potentiometer of 10k can be added if a variable output is required. The circuit as such gives three fixed-voltage outputs.

The power supply circuit is also shown in Fig. 9, which gives a zener-regulated + 5V supply and a simple filtered negative supply using a tapped secondary transformer.

Construction and testing

The circuit is simple enough to be wired easily on a commercially available strip type of printed circuit board, cutting the tracks and linking with wire as required. A socket should be used for the IC. The front panel, with a layout which may be as shown in Fig. 10, should first be prepared and the switches and the potentiometer fitted. The printed board may then be fitted with a bracket to the front panel and the interconnections made. The panel and the PCB may be housed in a box together with the transformer X1.

After checking the wiring, check for the proper voltages at the power supply, and then insert the IC carefully into its socket. Be sure to note the pin locations correctly and handle the IC either without touching the pins or wet your hands with water before handling it.

After switching on and keeping the slide switch S2 in the sine-wave position, look for the triangular wave at pin 3 on

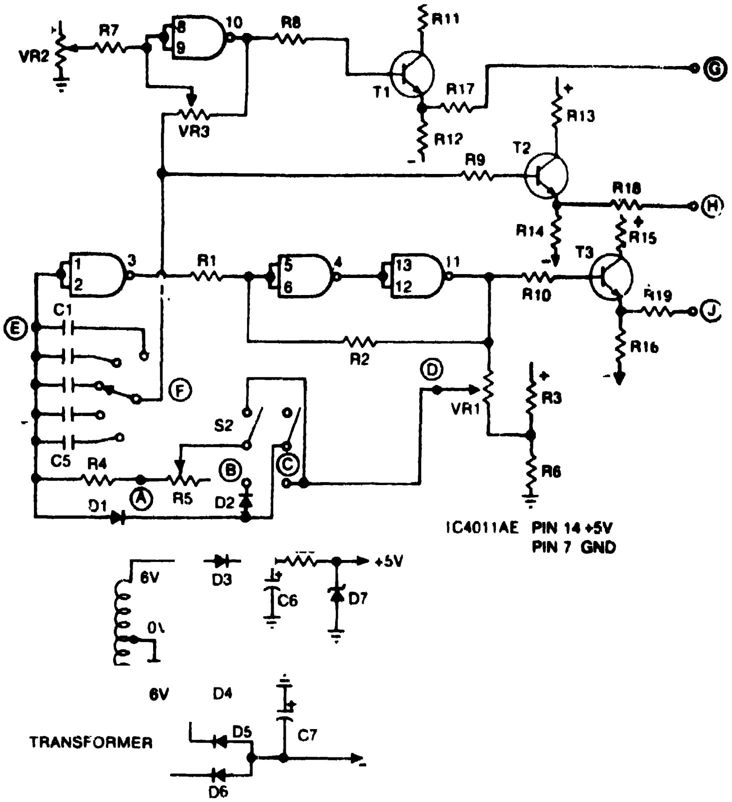

Fig. 9: Circuit diagram of the function generator

PARTS LIST

IC1—CD4011AE integrated circuit (see text)
T1 to T3—BC108b
D1, D2—IN4148 diode
D3 to D6—100mA, 25V rectifier diodes (SR100 or ECO51 type)
D7—5.1V, 500mW zener diode
R1—47-kilohm resistor
R2—100-kilohm resistor
R3, R4, R8, R9, R10—10-kilohm resistor
R5—100-kilohm, 23mm carbon potentiometer
R6—10-ohm resistor
R7—470-kilohm resistor
R11, R13, R15, R17, R18, R19—1000-ohm, ½-watt resistor
R12, R14, R16—1-kilohm resistor
R20—330-ohm, ½-watt resistor
(All resistors ¼-watt rated, unless specified otherwise)
VR1—22-kilohm vertical preset
VR2, VR3—220-kilohm preset
C1—10µF, 64V capacitor
C2—1µF, 64V capacitor
C3—0.1µF (any voltage) metallised polyester capacitor
C4—0.01µF (any voltage) metallised polyester capacitor
C5—0.001µF (any voltage) metallised polyester capacitor
C6, C7—10µF, 12V filter capacitor
X1—220V/6V-0-6V, 250mA transformer
S1—5-way (use one pole) band switch
S2—2-pole, 2-way slide switch
Misc.—Approx. 18cm X 15cm aluminium sheet for front panel, a suitable enclosure, 14-pin dual-in-line IC socket, 4 terminals, printed circuit board (if desired).

a cathode ray oscilloscope. A square wave should be available at pin 4. If either or both of the waves are absent, test whether all gates are functioning properly by observing the voltages at the input and output pins. If voltages at the input pins are high, the output pin voltage must be low, and vice versa. If any of the gate voltages stay in the intermediate range (neither high nor low), the reason could be: (i) the wiring may be incorrect, (ii) the IC may not have been inserted firmly in its socket or (iii) the IC has been damaged.

After getting the triangular wave, adjust its symmetry, using 'VR1'. Now look for the output voltages, at the output terminals, which would be present if the emitter-follower transistors were wired correctly. Next adjust the waveform of the sinusoidal wave using 'VR2' and 'VR3' one after the other.

Use only a CD 4011AE IC. Using a 4011B or 4011 will not give a sine wave in this circuit. The 4011B is a higher voltage type and hence the sine wave may not shape up well in this circuit.

Now switch the slide switch S2 to the sawtooth (Ramp) position. The sawtooth waveform should now be noticeable at pin 3. If not, check the interconnections to the switch via the diodes D1 and D2.

For frequency calibration, draw a circle of 270° arc on the panel and mark off graduations, initially with a pencil, as shown in Fig. 10. These will mark the frequency values. Using switch-1, you can get the various frequency ranges as:

Position of 'S1'	*Value of 'C'*	*Frequency range*
1	10µF	0.1 to 1.5 Hz
2	1µF	1 to 15 Hz
3	0.1µF	10 to 150 Hz
4	0.01µF	100 to 1500 Hz
5	0.001µF	1000 to 15000 Hz

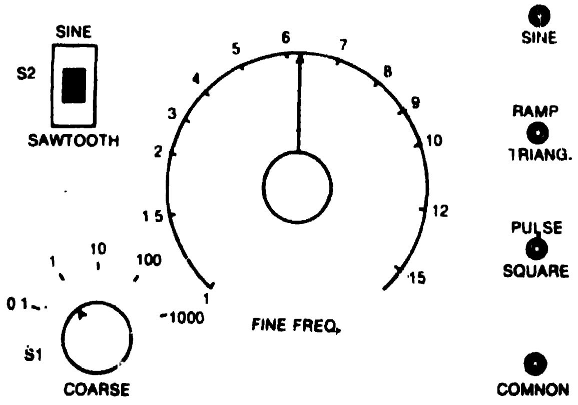

Fig. 10: Layout of the front panel

If a larger output voltage is required, a suitable amplifier circuit can be added.

All the output voltages have a DC level, which is about 2.5V for sine and square or sawtooth waves and about 1.5V for sine wave. At the frequencies above 10Hz, these may be blocked by a capacitor-resistor filter added externally while using the unit.

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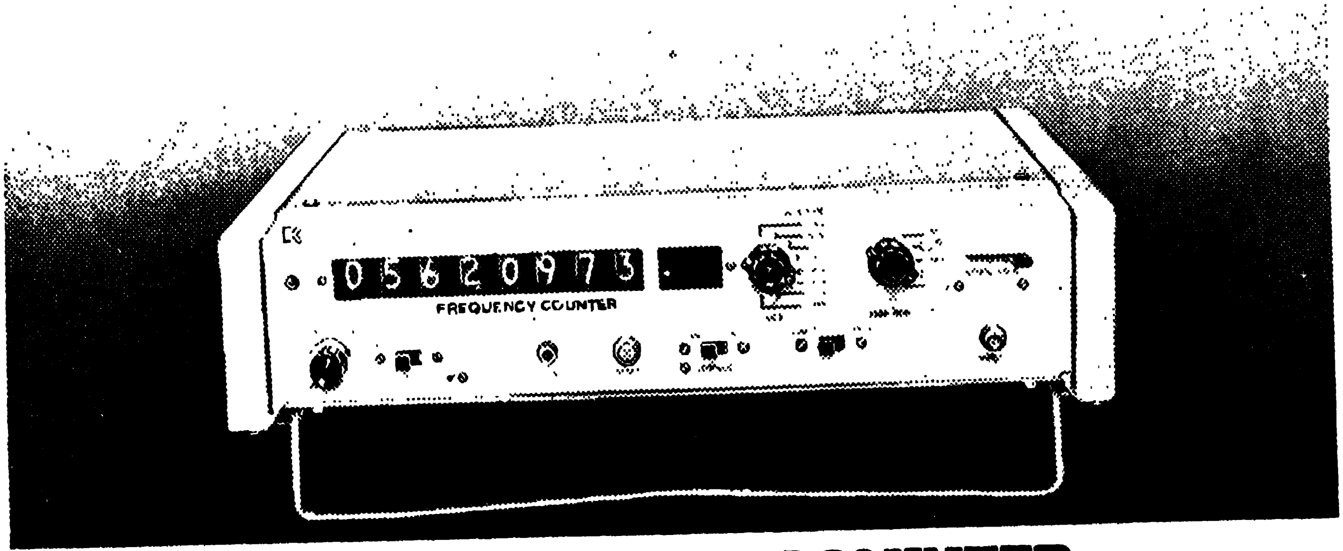

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CIRCUIT IDEAS

A Universal Schmitt Trigger

Several circuits exist for using NE 555 as a Schmitt trigger. The circuits are so arranged that when the voltage exceeds a set value, say V1, the output of NE 555 becomes high. When the voltage falls below, say V2, the output becomes low

Almost all such circuits use the internal hysteresis provided by the three 5k resistors. Though such circuits are simple to design, the Schmitt trigger action of such circuits puts a limitation on the designer. In such circuits, for example, the difference between V1 (the upper trip point) and V2 (the lower trip point) is fixed at 1/3 Vcc by the internal potential divider, and this difference cannot be varied.

The circuit shown in Fig. 1 avoids this limitation. It enables the use of an NE555 as a general-purpose Schmitt trigger with externally adjustable characteristics.

R1 and R2 form a potential divider of Vcc and apply a voltage

$$V1 = \frac{R1}{R1 + R2} \times Vcc$$

to terminal 6. Similarly, a voltage

$$V2 = \frac{R3}{R3 + R4} \times Vcc$$

is applied to terminal 2.

The input voltage V1 is applied to terminal 5 (negative terminal of threshold comparator). Also, the input voltage V1 is divided into half (by the internal 5k resistors) and is applied to the positive terminal of the trigger comparator.

When the input voltage exceeds twice the value of V2, the trigger comparator output becomes high and the output of NE555 becomes high. After exceeding twice the value of V2, if the input voltage reduces, no change in the timer output occurs until the input voltage goes below V1. When the input goes below V1, the threshold comparator output goes high and the timer output goes low. Thus the NE555 acts as a Schmitt trigger with adjustable hysteresis points of 2xV2 and V1.

Care should be taken to keep 2xV2 larger than V1, as is expected from any Schmitt trigger. If this is not satisfied, the timer will not behave as a Schmitt trigger but will operate as a simple comparator (with 2xV2 as the comparison voltage).

Another important point is that the internal impedance of the input voltage should be very low, so that the voltage at negative input of the threshold comparator is now significantly modified by the internal potential dividing resistors (connected to Vcc and earth).

A typical circuit is given in Fig. 2 along with input and output waveforms.

R. KRISHNAN

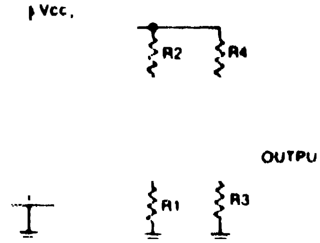


Fig. 1: NE 555 as Universal Schmitt Trigger

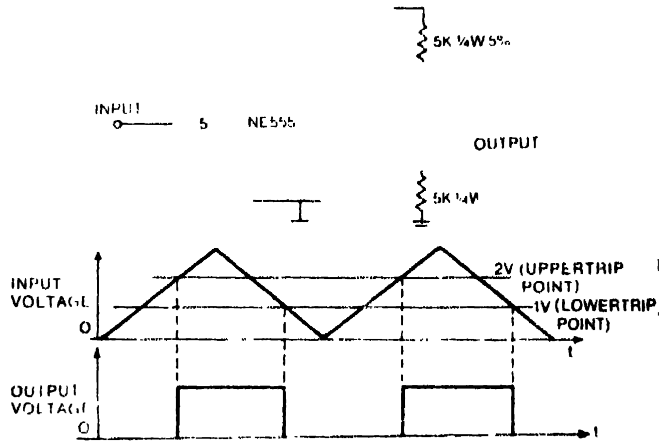


Fig. 2: Actual circuit for the given specifications and input output waveforms

Specifications

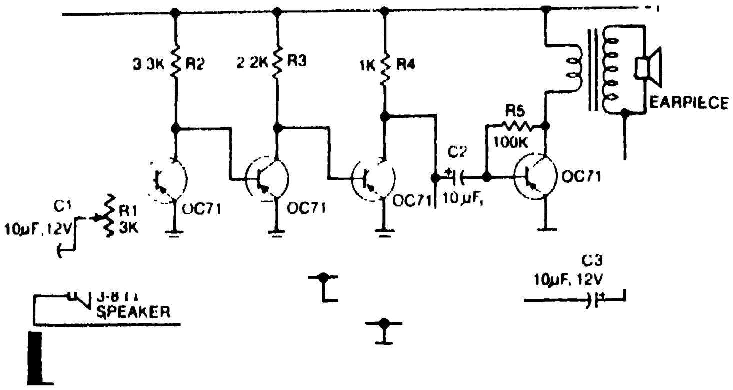
Misc -- Penlight cell (with holder), wires

1. Upper Trip (2xV2) 2 volts
2 Lower Trip Point (V1) 1 volt

(Since V2 = V1 = 1V, one potential divider is sufficient)

Miniature Hearing Aid

The circuit of the hearing aid shown here is simple and gives a sufficiently high volume.



The transistors used are easily available. There equivalent may also be used.

In order to save space, the base of the former transistor is biased by the latter's collector load, except in the case of the last transistor.

The speaker works as a microphone. Any speaker may be used, but it should be as small as possible. The transformer used here is a driver transformer, usually used in portable radio receivers.

A 1.5V penlight cell is used for supply. As the current consumption is very low, it lasts for a long time.

DILIP CHAUDHARI

Mains Lamp Flasher

With Added Attractions

This electric lamp flasher which may be used as a warning light works directly on 230V AC mains.

The diodes D1 to D4 in Fig. 1 convert the alternating voltage into pulsating DC voltage. Components R1, C1, R2 and C2 form the timing circuit to control the flashing rate. When the charged voltage across the capacitor C2 exceeds the neon's (N1) firing voltage, the neon fires and provides the required triggering current to SCR. Then the SCR also fires and acts as a short, connecting the lamp across the AC mains. Finally, when the voltage across capacitor C2 falls below the maintaining voltage of the neon, the neon stops conducting and the SCR also returns to its non-conducting state, thus disconnecting the lamp from AC mains. The capacitor C2 starts charging again and the cycle repeats.

The lamp flashes in this circuit once every second. The rate can be varied, if required, by adjusting R2.

The circuit of Fig. 2 is a simpler and a more economical arrangement. It uses only one diode instead of four for rectification. In fact, an SCR itself is a rectifier and power halving is done by it. The diode D1 is however required because without it the timing period will get disturbed during negative cycles. Incidentally, it helps to increase the reverse voltage ratings of the SCR and also protects the electrolytic capacitors by providing a proper polarity voltage. In this arrangement the lamp flashes at a reduced brightness. Thus the circuit acts as a lamp flasher-cum-wattage halver. A 100W bulb used in this circuit, acts as a 50W lamp flasher.

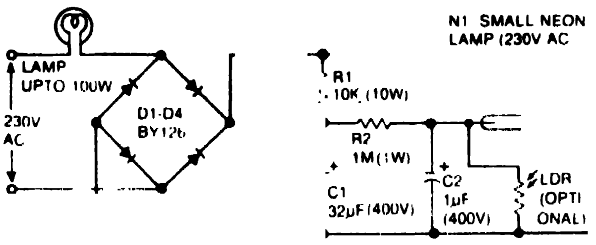


Fig. 1

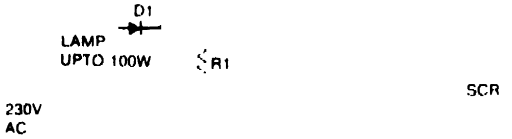


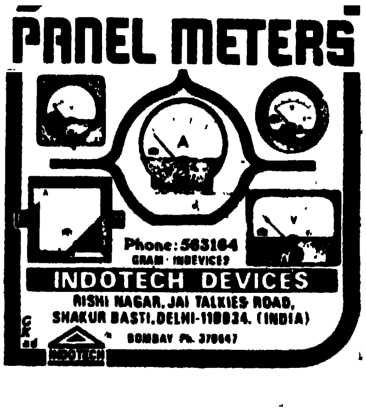
Fig. 2

The lamp flasher may be light-controlled by adding an LDR across the timing capacitor C2. An LDR has high resistance in darkness and has little effect on the circuit functioning. When light falls on it (during day time), its resistance becomes sufficiently low to prevent the capacitor from charging to the neon lamp firing voltage.

Instead of LDR a simple switch or reed relay contacts can also be used to short-circuit the capacitor C2 when the flasher is not required. Thus, by controlling low current path of triggering circuit, the high load current of the lamp can be switched on and off very conveniently.

Caution: Since the flasher uses a SCR, RF interference can be a problem. It is therefore advised to use a filter for eliminating the interference.

D. VENKATASUBBIAH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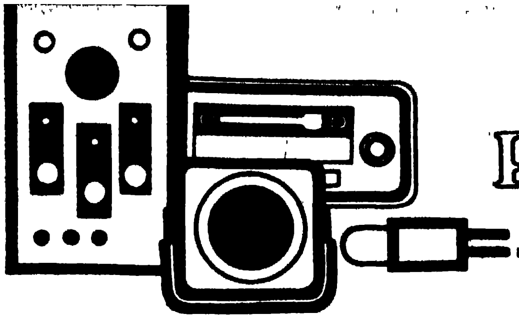
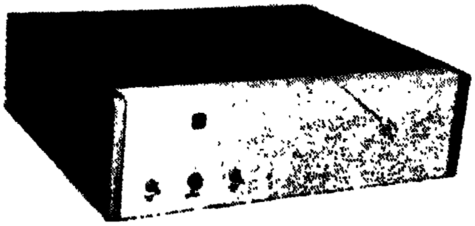


PRODUCT PROFILES

ELECTRONIC EXCHANGE

ITI has developed a 10-line electronic exchange suitable for intercommunication in hospitals, banks, commercial and industrial organisations. Incorporating integrated circuit technology, the exchange can operate directly from 230V power supply. It is now available in two designs—for one conversation at a time and for two simultaneous conversations. The exchange weighs only 10 kg.

Unlike office intercom system, the electronic PAX requires only 2-wire cable for interconnection telephones spread over a large area—long lines up to 2 kms possible. Noiseless in operation (as there are no moving parts), it ensures complete secrecy. Besides it is easy to install and needs almost no maintenance.



Contact: Indian Telephone Industries, Dooravani Nagar, Bangalore 560016.

DIGITAL PROGRAMME CONTROLLER

Thermadyne has introduced versatile 'Accutron' digital programme controller for batch process, machine tool and other machine operation applications. This programme controller is suitable for applications where step operations are done on the basis of time and limit switches or any other switches like level, temperature etc.

The step operations can be programmed for any number of output relays for each step and the operation of relays can be repeated, depending upon the particular applications.

The controller can be supplied with 10 or multiples of 10 steps, and 10 or multiples of 10 output relays. The feedback interlock system provides for Time 'AND' External Contact or Time 'OR' External Contact logic.

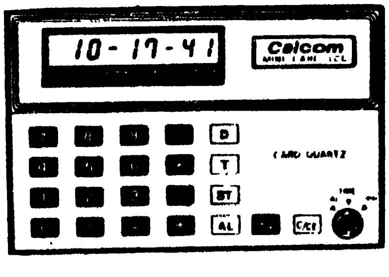
Another facility provided gives the engineer a choice to select either of the two time ranges of 9 hrs - 59 mts or 9 mts - 59 secs for individual steps. Provision is also given for external contacts to start or stop the controller.

Contact: Marketing Division, Thermadyne Private Ltd, C-120 Naraina Industrial Area, New Delhi 110028.

CALCULATOR-CUM-CLOCK

Calcom's Card Quartz calculator is the size of a visiting card and incorporates an alarm clock. Only 8mm thick, this 8-digit LCD display calculator includes a memory. In case you forget, its 'auto power-off' facility switches off the calculator after 7 minutes.

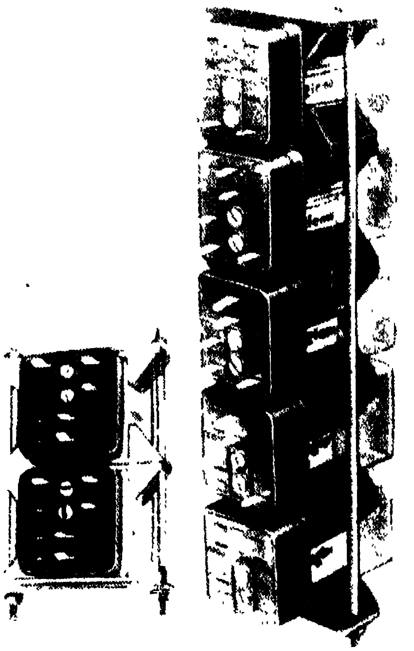
When in use as a clock, it shows hours, minutes and seconds. In addition it can show day and date and give off alarm or hourly beeps. It may be used either in 12-hours or 24-hours mode.



Contact: Calcom Electronics, G-2/16, Ansari Road, Darya Ganj, New Delhi 110002.

RELAY MOUNTING SYSTEM

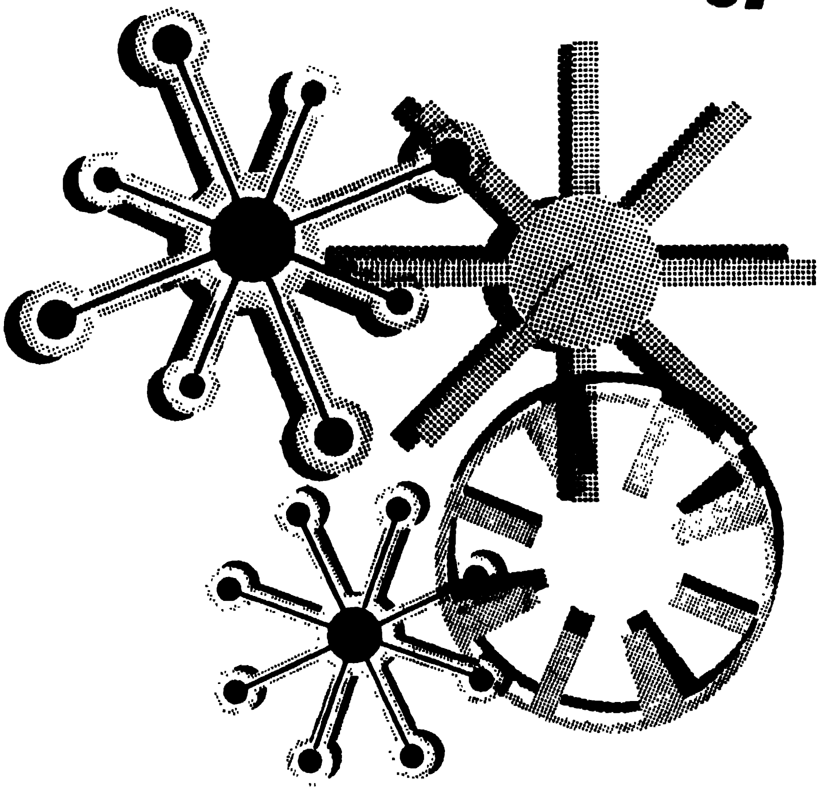
The cascade mounting system of 'Eagleman' relaytime series 102 enables mounting of up to ten relays on only two spaced holes in a chassis. The system makes the optimum use of vertical space and permits flexibility in providing one or more relays in the same cubicle without additional fixing holes. The mounting is simple, and any relay may be replaced without disturbing others. The pack can be supplied factory-assembled and tested.



Contact: Eagleman Enterprises, 3/19A Kirtinagar Indl Area, New Delhi 110015.

State-of-the-art electronics in India-4

BEL specialises in Microwave Tube technology



Magnetrons for navigational, search and fire control radar systems conforming to military specifications

From the very beginning BEL has been continually upgrading its vacuum tube technology. Magnetrons which are high power oscillator tubes operating at microwave frequencies, are a class of vacuum tubes requiring computer-aided design and sophisticated process technology. BEL designs and manufactures a number of fixed frequency, tunable, pulsed and CW magnetrons for defence applications.

Yet microwave tubes are just one facet of BEL's component capability.

The other well known components that professionals all over stake the performance of their equipment on are: Receiving Valves, Transmitting Tubes, X-ray Tubes, Cathode Ray Tubes, TV Picture Tubes, Hybrid Microcircuits, Integrated Circuits, Germanium and Silicon Semiconductors, Passive Components and Printed Circuit Boards — just to name a few.

BEL's contribution in fact goes far beyond the mere supply of high quality, high reliability components. It constitutes the pioneering work done in the design and manufacture of the widest range of components and equipment conforming to JSS, MIL, BSS and DEF standards employing the latest trends and state-of-the-art technology.

Yet BEL's most important contribution is the creation of total systems capability in electronics in India.

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COMPANY PROFILES

HMT to Manufacture Electronic Watches

Hindustan Machine Tools Limited (HMT) plans to gradually switch over to production of electronic watches, according to a recent newspaper report. The switchover from mechanical to electronic watches is expected to span over the next four to five years.

The proposal submitted to the union government in this regard envisages the manufacture of two million electronic watches with knowhow for components from the Citizen Company of Tokyo. It may be noted that this Japanese firm was also HMT's collaborator for the manufacture of mechanical watches.

Under this project, 12 captive assembly units will be set up at different states. While HMT will initially import components from Citizen for these units, over a period of time the required components will be manufactured in a plant which is to be set up at Tumkur in Bangalore.

HMT also proposes to set up an ancillary complex as a part of the project. This complex will comprise 18 independent units for the manufacture of one million watch cases.

The two-million watch manufacture project is estimated to cost Rs 300 million and the ancillary complex will cost around Rs 64 million, leading to a total expected investment of Rs 364 million. This investment will be phased over a few years as HMT proposes to begin manufacture of electronic watches gradually—200,000 watches a year going up to 400,000 watches a year and so on.

Telerad Closed Down

Radio and television manufacturing unit of Telerad (belonging to Sarabhai group) has closed down due to labour trouble. The company has incurred a loss of about Rs 10 million.

In November last, the Maharashtra government had permitted the company to close down its radio division. One of the unions took a realistic view, while another union opposed this decision of the management and the Maharashtra government. The inter-union rivalry resulted in a long-drawn strike.

While the management was keen to continue the marketing of TV sets under its brand name, though manufactured by small-scale units, the workers opposed this move. The entire staff of about 700 persons has therefore been retrenched

Siemens: Satisfactory Performance

In spite of serious disruptions in operations arising out of a disturbed labour situation, Siemens India has been able to maintain its dividend during 1978-79 at 16 per cent involving a payment of Rs 115 million.

The company did suffer a slight setback last year in the sales turnover which dropped by 6 per cent to Rs 712 million. The pre-tax and after-tax profits also declined from Rs 870 million to Rs 580 million and from Rs 250 million to Rs 200 million respectively.

The company's chairman, Mr D.M Khatau, hopes for a much better performance during the current accounting year with the labour situation under control, and with the order books of the company standing at an all time high level of Rs 765 million at the end of February 1979.

During 1978-79, Siemens India made a remarkable breakthrough in turnkey project business. It expects to bag big export turnkey contracts in the field of power generation, signalling and telecommunications this year.

EFC Rejects BEL Proposals

Taking a tough stand against the growing monopolistic status of Bharat Electronics Limited (BEL), the central government's high-level expenditure finance committee (EFC) has turned down a BEL proposal for setting up two new projects.

These projects were to be set up for the manufacture of radar and communications equipment, navigational aids and some sophisticated items needed by defence, civil aviation and other government departments.

The main force behind this move appears to be Prof. B. Nag, the new chairman of the Electronics Commission. The chairman wants such jobs to be taken up by the state electronics development corporations, which he feels should be developed into alternative sources for sophisticated defence and communication equipment, and should be provided with all technical support towards this end.

This firm stand against BEL is the first of its kind in the company's history and has not come too early. It is only ironical that it has been led by a person who was a director of BEL at one time.

Site for Third ITI Unit Decided

The Indian Telephone Industries (ITI) is likely to set up its third switching board and crossbar equipment factory close to Bhubaneswar city.

The unit, employing about 700 people, will be set up at an estimated cost of about Rs 650 million. It will produce switching and crossbar equipment of the value of Rs 400 million annually.

The Industrial Promotion and Investment Corporation of Orissa (IPICOL) is coordinating this central sector project which includes the setting up of a housing colony for ITI's staff and workers.

Keltron TV Production Stays at 5000 Sets

Though Keltron was issued a letter of intent for increasing its TV production capacity from 5,000 sets a year to 10,000 sets a year in December 1977, it has not yet implemented the expansion and has requested for an extension of the validity of the letter of intent. This was stated by Prime Minister Morarji Desai in a written answer to a question in Parliament.

However the non-expansion of TV production capacity by Keltron is not expected to result in a shortage of TV sets in Kerala, even if one takes into account the increase in demand resultant upon the setting up of a TV centre at Trivandrum. This is because the major TV set manufacturers have already established countrywide sales networks so that various brands of TV sets will be available in Trivandrum when the TV centre is set up.

Production of TV sets by Keltron rose steadily from 242 sets in 1974 to 4929 sets in 1977. It however fell to 4336 sets in 1978.

BHEL — Siemens Collaboration Still Under Consideration

In his answer to a question raised in Parliament, Prime Minister Morarji Desai disclosed that the proposed technical collaboration agreement, and specially the segment relating to electronics, between Bharat Heavy Electricals Limited (BHEL) and Siemens AG of West Germany has been examined by the Department of Electronics.

However the agreement is still under consideration of the department; no clue as to the decision taken by the government was given by the Prime Minister.

Among electronic items, the proposed collaboration covers monocrystalline silicon, power semiconductor devices, thyristor-based power electronic and control electronic equipment for variable speed DC drives, and systems engineering knowhow relating to industrial and control electronic equipment.

ECIL Developing Indian Script Computers

The Electronics Corporation of India Ltd (ECIL) has succeeded in generating Devanagiri and Telugu characters on display screens. This was pointed out by Prime Minister Morarji Desai in a written answer to a question in Parliament.

For generating the characters of Indian scripts on display screens, a dot matrix printer for 3-line printing of text is used. 3-tier printing is necessary because the upper and lower 'matras' of the script have to be provided for.

ECIL has also developed a Fortran compiler to process texts in Hindi or Telugu.

According to Mr Desai, several promotional measures have been taken by the Department of Electronics to make people more aware of the feasibility and potential of computers in Indian languages. The most recent was a symposium on 'Linguistic Implications of Computer Based Information System' organised from 10th to 12th of November, 1978.

Philips Mobile Lab Touring India

The Philips Mobile Laboratory, claimed to be unique in the world, is now in India and will be touring the major centres of the country during the next six months.

In Delhi, for instance, a demonstration of the working of this laboratory was held on March 26.

Among other things, this mobile laboratory deals with various aspects of providing better perception to road users, leading to maximal road safety.

DCM Data Products gets FICCI Award

DCM Data Products has won the 1978 FICCI award for research and development (R&D) in science and technology.

It has made significant contribution in the area of electronics by encouraging domestic talent and using, as far as possible, indigenous components. The electronic calculators and business machines manufactured by the company have not only resulted in considerable savings in foreign exchange but have also assisted in the growth of a number of ancillary units.

The company has devised a system which replaces key-punch, and the verified data prepared on the system can be directly fed into a processor or transferred on to a magnetic tape. This process does away with the need of a card reader.

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FACTS & FIGURES

LICENCES AND LETTERS OF INTENT

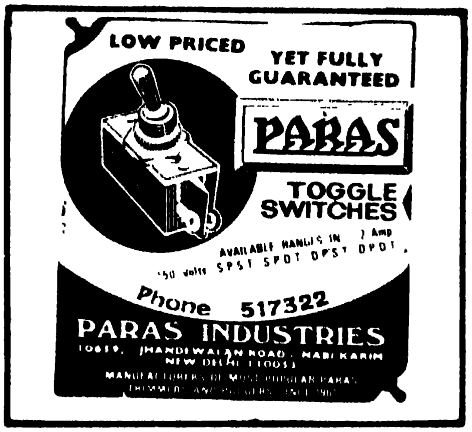
The following licences and letters of intent were issued to electronics firms under the Industries (Development and Regulation) Act, 1951 during the months of January and February 1979.

Name & Address of the applicant and location of the undertaking (1)	*Date & type of licence* (2)	*Article* (3)	*Quantity per annum* (4)
LICENCES			
Ainsworth Balances Ltd, 501.Janmaboomi Chambers, Walchand Hirachand Marg, Bombay 400038. (Nasik-Maharashtra)	22.2.79 (NU)	1. Single/dual pan electronic precision balance (weighing range up to 16,000 gms)	5000 nos
		2. Single/dual pan electro-mechanical (weighing range up to 7000 gms)	3000 nos
		3. Sedimentation balances (for determinations in the particle size range 1 to 150 microns)	1000 nos
		4. Thermogravimetric balances (weighing range 25 gms)	250 nos
		5. Automatic tablet weigher (weighing range 1 4 gm + 0.14 gm)	250 nos.
		6. Automatic weighing units (electronic precision balances for special applications)	250 nos.
LETTERS OF INTENT			
Intrasil Incs., 10710 North Tantau Avenue, Cupertine, California 95014, USA. (SEEPZ-Maharashtra)	16.1.79 (NU)	Complex integrated circuits	20 million nos.
Hindustan Cables Ltd, P.O. Hindustan Cables, Hyderabad 500051. (Hyderabad-Andhra Pradesh)	17.1.79 (SE)	Jelly filled cables	560,000 CKM (after expn)
Grindwell Norton Ltd, Army & Navy Bldg, 148 Mahatma Gandhi Road, Bombay 400023. (Hosur-Tamil Nadu)	18.1.79 (NA)	Ultra-pure silicon (Polycrystalline, single crystals and wafers)	15 tonnes
Mettur Chemical and Industrial Corpn Ltd, Mettur Dam 636402. (Salem-Tamil Nadu)	18.1.79 (NA)	Silicon (metal) pure electronic grade	10,000 kgs
M.S. Kamath No. 13, Serpentine Street, Richmond Town, Bangalore 560062. (Mysore-Karnataka)	18.1.79 (NU)	Ceramic capacitors	40 million nos.
Shreeshyla Electronics Pvt Ltd, Shreeshyla, Kanakpura Road, Bangalore 560062. (Bangalore-Karnataka)	18.1.79 (NU)	Electronic grade copper-clad laminates	720,000 sq. mtrs
Amphetronix Ltd, P.B. No. 1, Plot No. 105, Bhosari Indl Area, Poona 411026. (Maharashtra)	22.1.79 (NA)	1. Professional grade switches	500,000 nos.
		2. Professional grade relays	500,000 nos.
Jyoti Ltd. P.O. Chemical Industries, Baroda (Baroda-Gujarat)	23.1.79 (NA)	1. Vacuum contactors 3.3 kV—11.0 kV class	600 nos.
		2. Sheet steel clad control panels incorporating vacuum contactors 3.3 kV—11 kV class	400 nos.

(1)	(2)	(3)	(4)
Hindustan Cables Ltd, P.O. Hindustan Cables, Dist Burdwan, West Bengal. (Burdwan-West Bengal)	23 1.79 (NA/SE)	1. Jelly filled cables 2. Telecommunication cables (coaxial cables)	600,000 CKM 2000 TKM (capacity of expn)

LETTERS OF INTENT LAPSED DURING FEBRUARY 1979

Name of undertaking & location	*Item of manufacture*	*Date of licence*
Hasmudh S Desai C/o Indo Orient Agencies (P) Ltd, Bombay, (Gujarat)	ECG monitor etc	28.11.77 (Lapsed)



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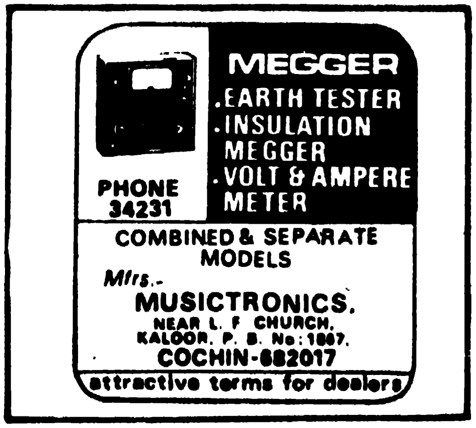

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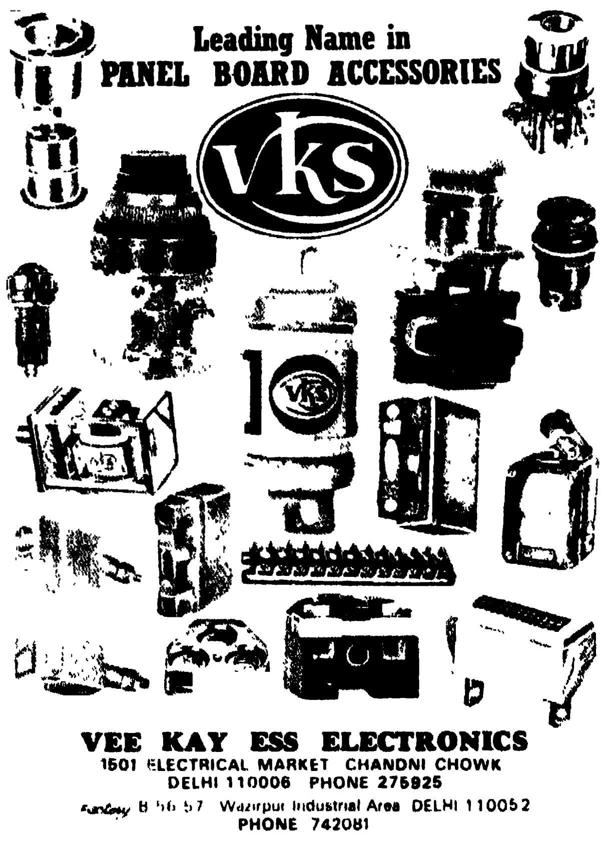

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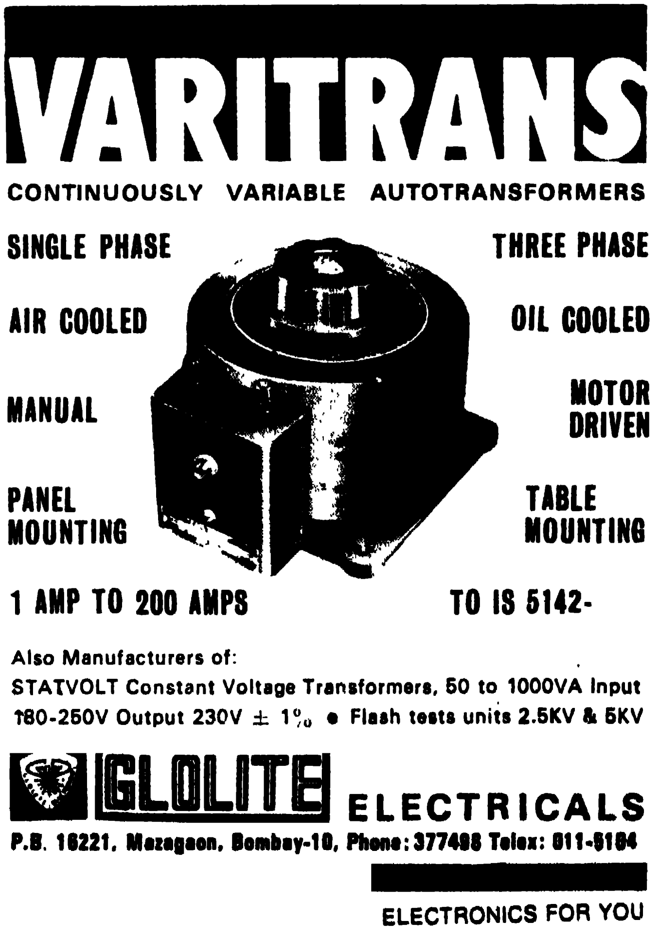

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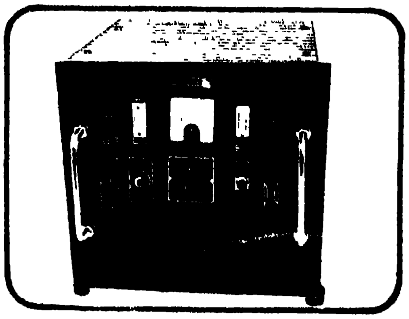

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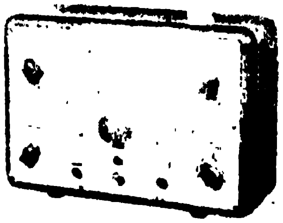

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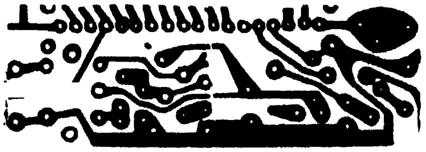

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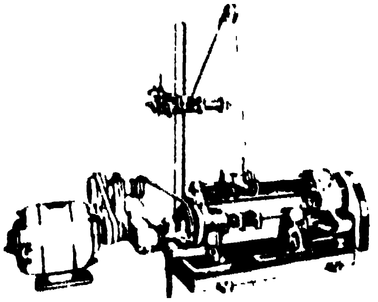

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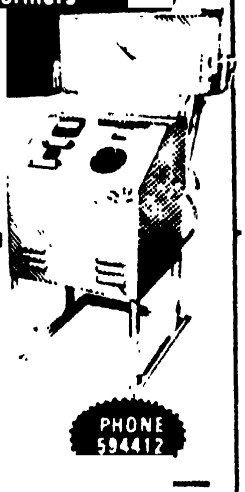

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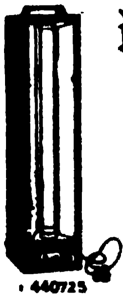

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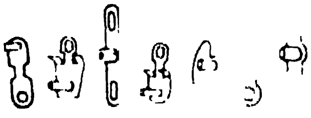

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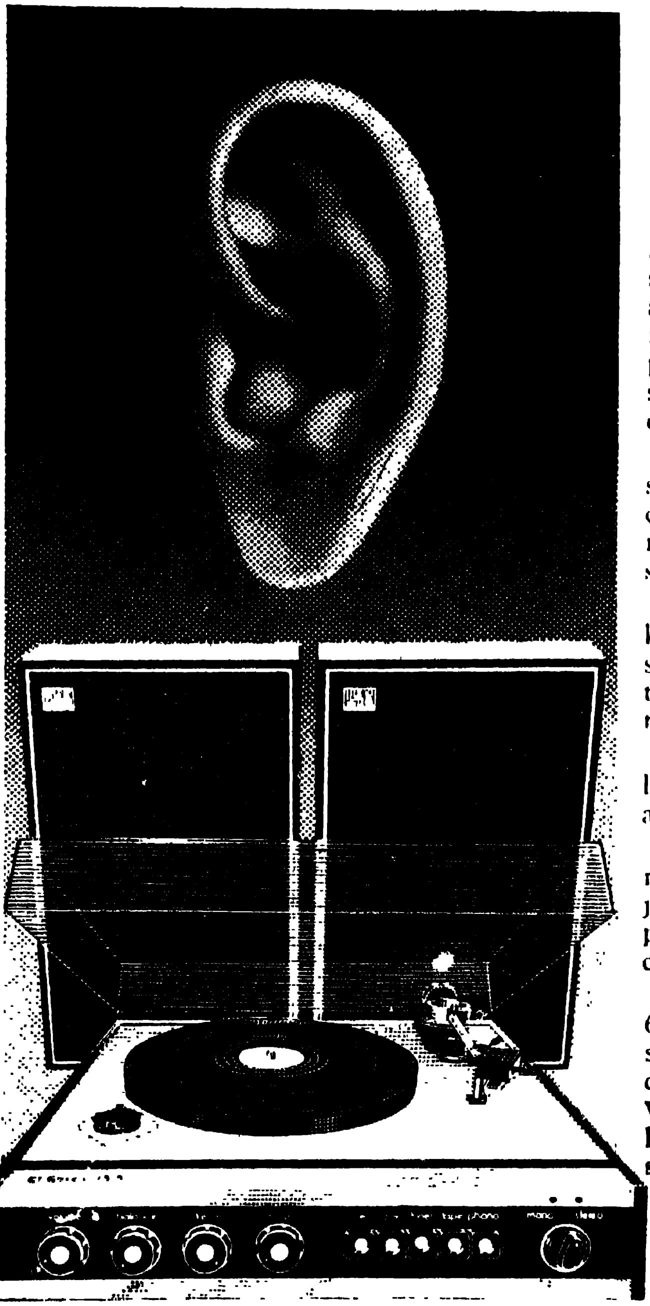

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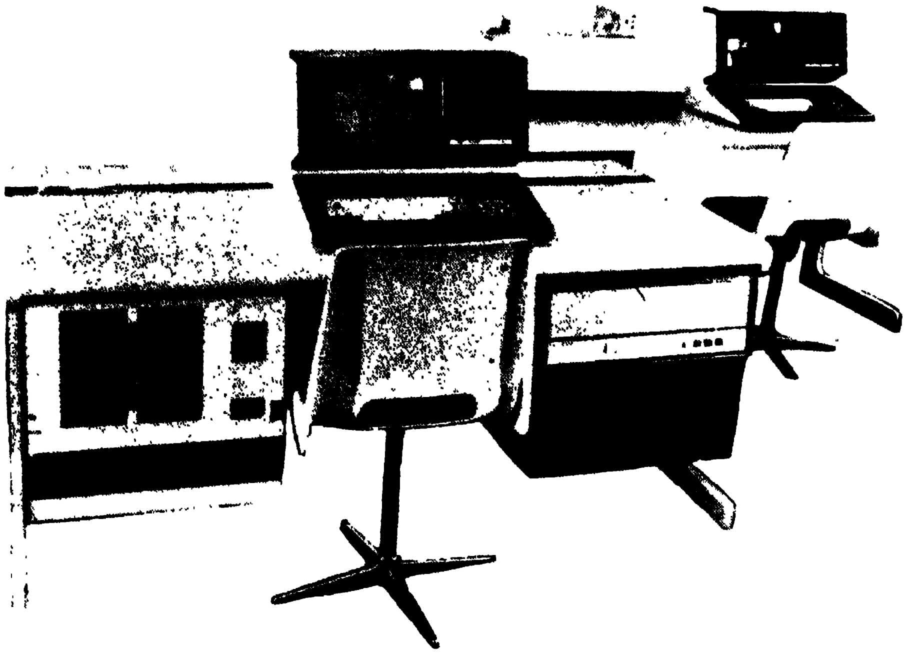

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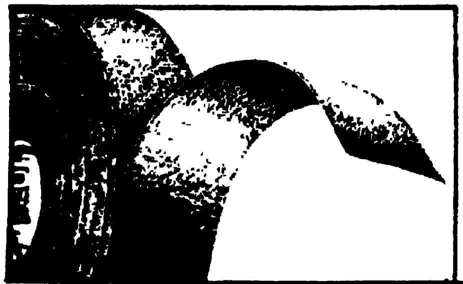

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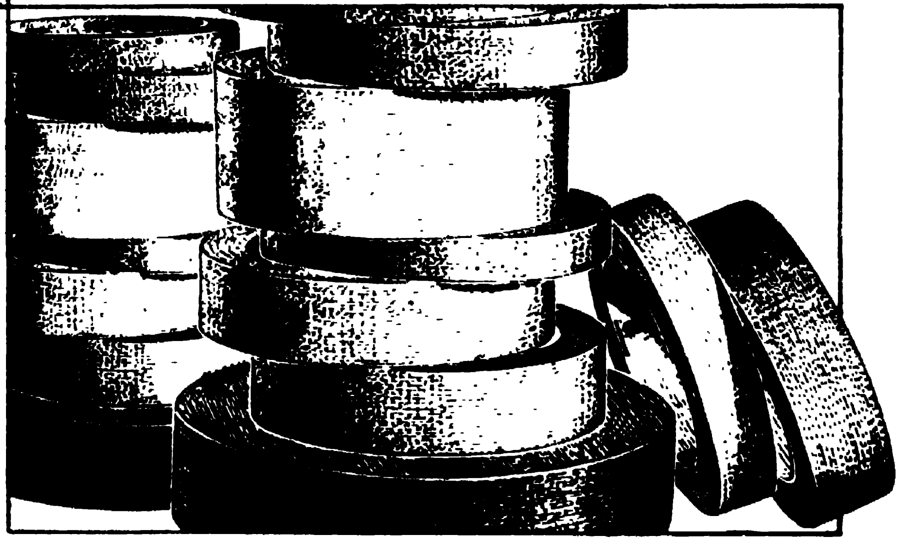

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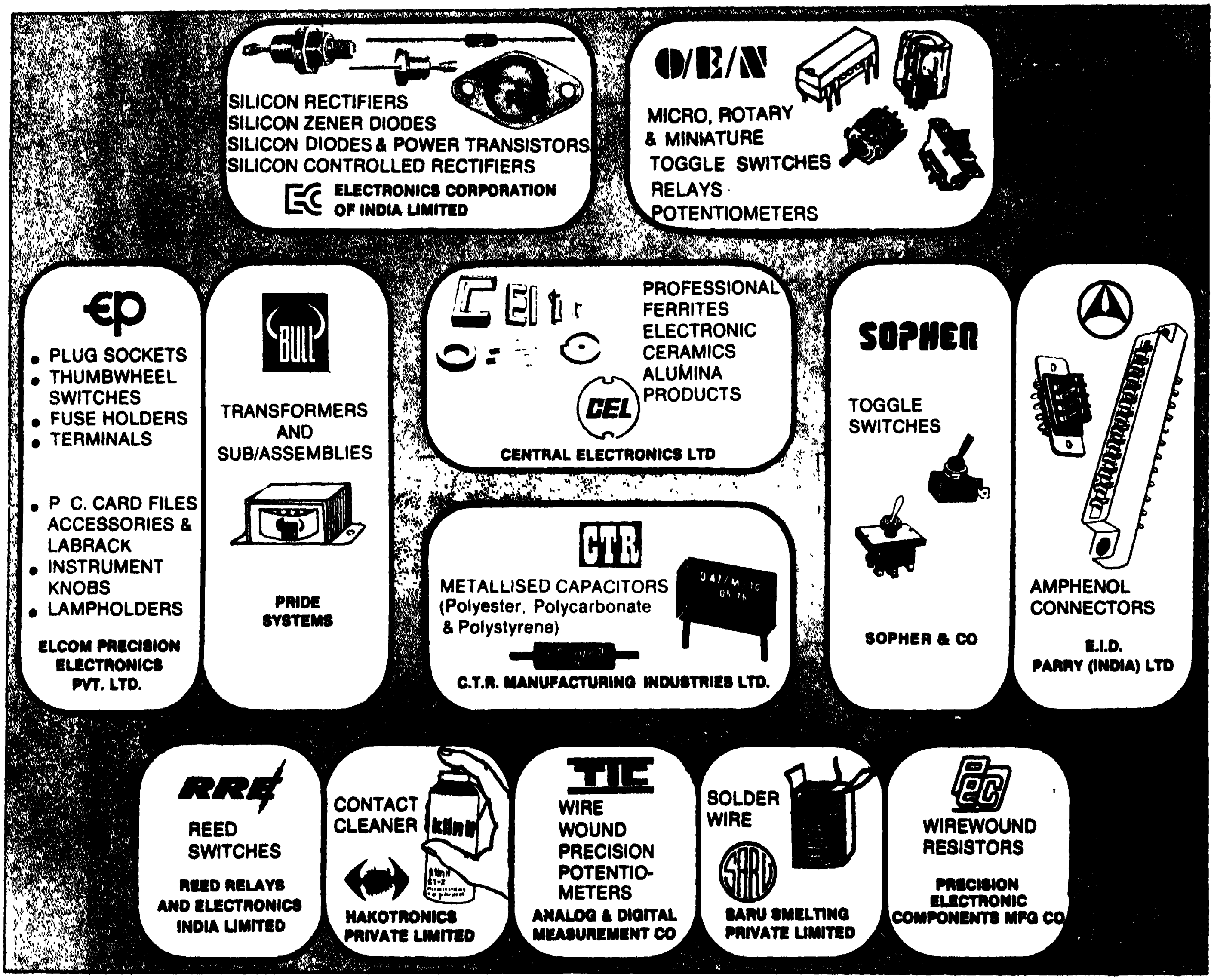

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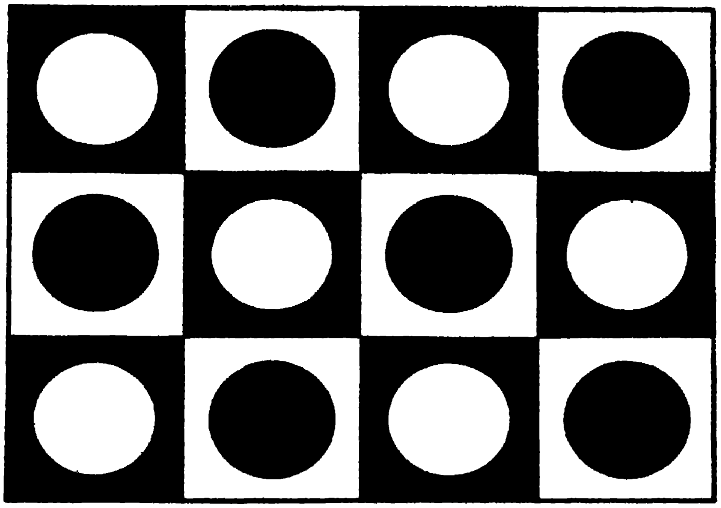

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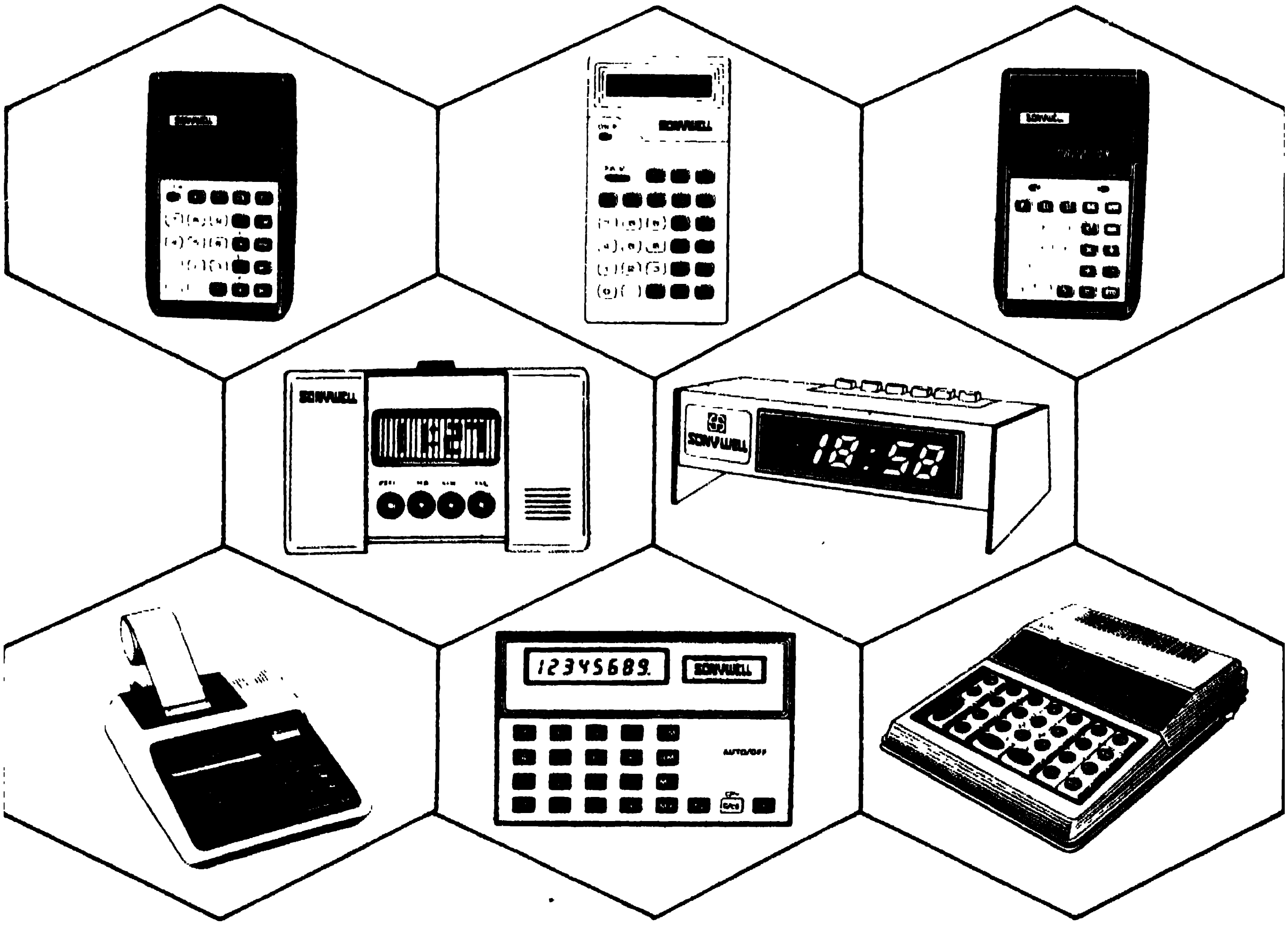

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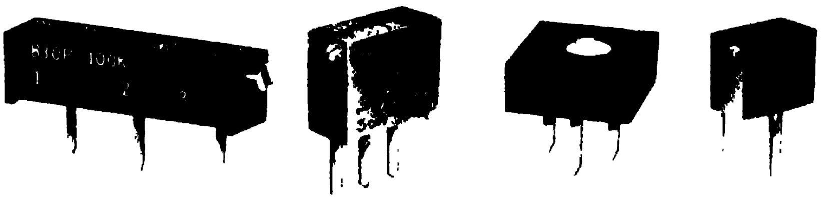

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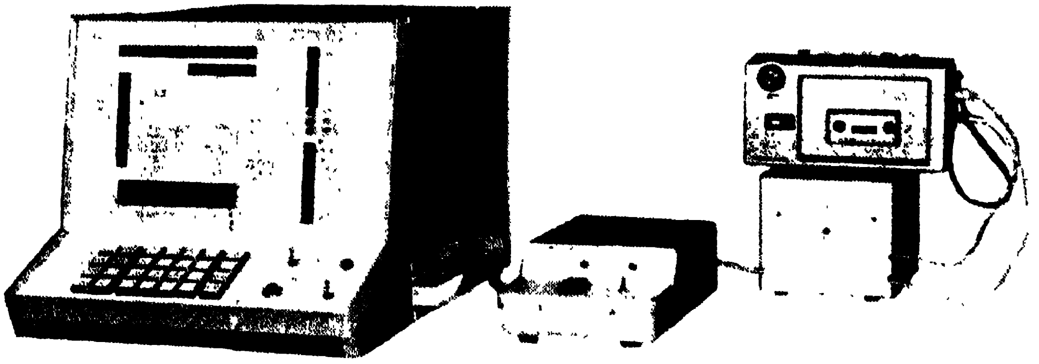

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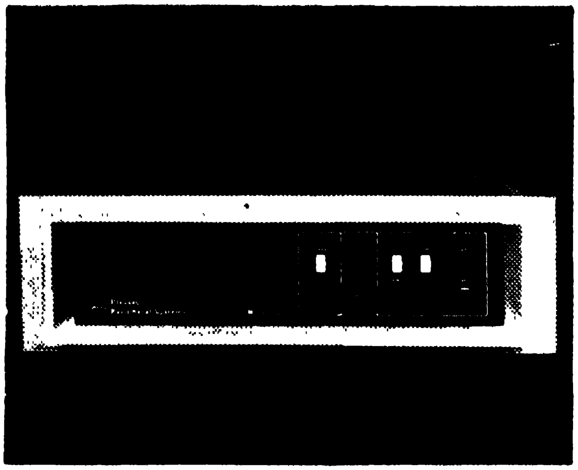

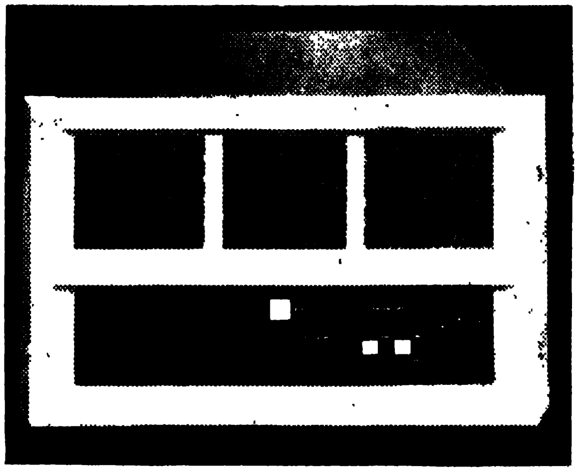

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NEXT MONTH

Annual Number 1980
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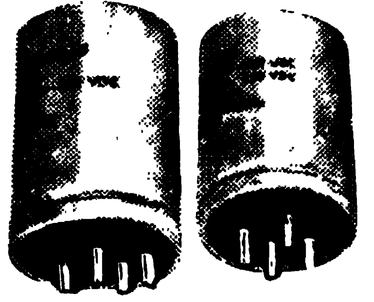

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EDITORIAL

WANTED: A PLAN FOR ACTION

ELCINA rightly decided to postpone the holding of a seminar in September this year to a date in January-February next year. The political environment being what it is, no useful purpose would have been served by the proposed seminar.

Postponement of the seminar does not however mean that the problems facing the electronic components industry in this country will cease to exist; they are there all the same and may take acuter shape in the next few months.

Seminars in this country have taken the shape of 'talking sessions' where the participants air their views (or grievances) and go back home satisfied that they have performed a useful social purpose. There is too little conference or thinking before the holding of the seminar and still less follow-up action after the seminar. Consequently, all the seminars held in this country during the last decade have not resulted in providing to the industry the facilities that it needs. Issues on which the Department of Electronics and the Electronics Commission have agreed with the industry, have evoked poor response from the corridors of central secretariat. The industry must know that it has to bring round those bureaucrats who in different ministries have been feeding their ministers with background notes which are patently anti-electronics industry.

For example, the common impression which prevails among ministers and bureaucrats in New Delhi is that the electronics industry is essentially a luxury industry. They equate this industry with consumer electronics industry, not knowing that out of every rupee of production of this industry, consumer electronics (radio, television etc) constitutes only 28 paise. The electronics industry today provides communication equipment, aerospace and defence equipment, computer control and instruments, and components in a big way. Therefore, to treat this industry as a luxury industry is doing grave injustice to it.

It is true that the consumer electronics companies splash every day big advertisements in daily newspapers and the gullible ministers and bureaucrats are carried away by them. Such advertisements may enhance the sales of particular companies, but they create a wrong impression in the minds of the policy-makers. Let these companies publish educative advertisements as well which portray the real state of this industry. Let ELCINA's next seminar prepare a document which sets out all the facts, figures and arguments proving that the electronics industry is not a luxury industry, and that it plays a very useful role in various other vital industries and walks of life.

Then, there is the well-known and well-recognised fact that the rate of obsolescence in this industry is very high and therefore a higher rate of depreciation should be permitted to equipment used by it. The Department of Electronics has recognised this fact and it has very often been stated in unequivocal terms in its annual reports. For some unknown reason, the central Ministry of Finance has turned a deaf ear to this suggestion and no positive action has so far been taken. Perhaps it will be worthwhile for ELCINA to invite the central minister of finance (whoever that holy man may be early next year) along with his advisers to the next seminar and put before them all the arguments in favour of an increased rate of depreciation for equipment used in this industry. Better still, a competent group should prepare a well-reasoned document to be presented to the minister; it should also take appropriate follow-up action after the seminar.

Again, the indigenous supply of electronic components has been far below requirement with the result that the gap between demand and supply is currently being filled by heavy imports. The question which needs to be answered is: Why when a large number of industrial licences have been issued by the government, not many of them reach the fruition stage. Is it the speedy onslaught of new technology which has made entrepreneurs slow and hesitant? Is it the absence of vital facilities? Whatever the reason, it is a fact that sufficient investment is not forthcoming to "harness the fruits of latest advancements" This is another area which cries out for clear documentation.

Let ELCINA prepare its plan of action. Mere words will not do. It is not a minor partner of the electronics industry. The industry produced components worth Rs 1170 million in 1978. During the next seven years, it will need new investment of the order of Rs 2000 million in order to fulfill the needs of the electronics industry. This is a challenge which needs a realistic plan of action backed by heroic determination to rise to the occasion. Will the components industry accept this challenge?

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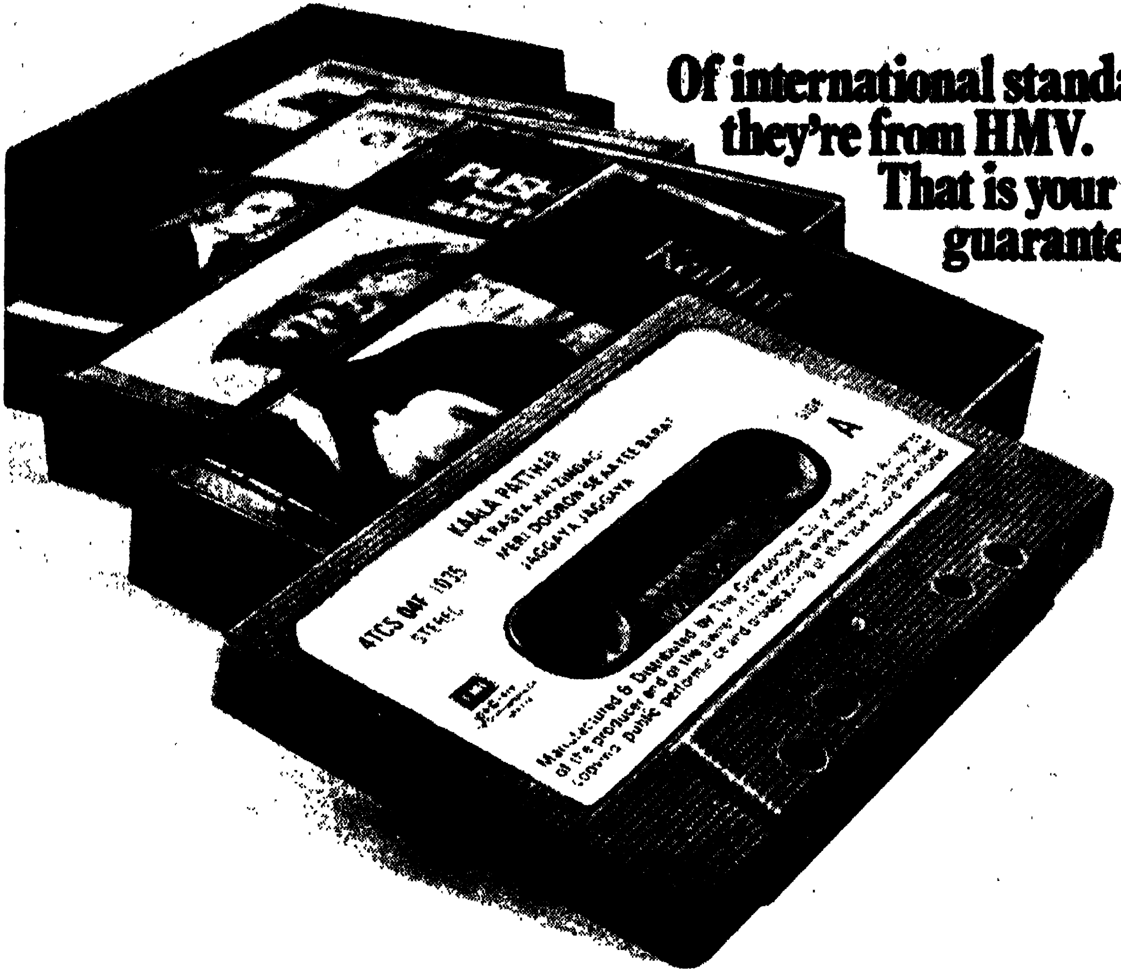

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WHAT'S NEW

In India ...

Vacillations and Delays Plague Semiconductor Project

The semiconductor devices project of the government-owned Semiconductor Corporation of India at Mohali, near Chandigarh, was initiated in 1974 to import parts from the US and Japan for assembly of strategic solidstate devices.

Now five years after the project was launched, a newly-appointed management has shelved the idea of assembly of parts. It has, instead, decided to go in for manufacture of solidstate devices with foreign collaboration. A six-man team led by Dr Chatterjee, chairman and managing director of the complex, has been sent to USA and Japan in search of new technologies towards this end.

This change in policy will increase the gestation period of the project to about a decade. The choice of technology will itself take some time.

The waste of time, energy and money on most of what was done in the past five years apart, this Rs 150-million project will also suffer from cost escalation because of the delay.

PEEIMA—A New Association of Electronics Manufacturers

An association of electronics manufacturers, christened 'Professional Electronic Equipment & Instruments Manufacturer's Association (PEEIMA)' has been formed recently in Bombay, with professional equipment and component manufacturers from all over the country as its members.

Mr I.T. Mirchandani, managing director of Advani-Oerlikon, has been elected chairman of the association and Mr P.K. Sandell, managing director of Uptron Powertronics, has been elected convenor.

The association has been set up with specific objectives in mind, chief among them being: (i) to promote the growth of the professional electronic equipment industry; (ii) to encourage growth of small-scale technical enterprises; (iii) to ensure that there is no duplication in R & D efforts, with private enterprises and the government funding the same venture; and (iv) to make available pooled expertise to the central and state governments for formulation of policies, plans and objectives.

New Satellite Being Developed at ISRO

The Indian Space Research Organisation (ISRO) proposes to develop a three-axis stabilised satellite in sun synchronised orbit of about 600 to 1,000 km for remote sensing applications, for managing natural resources.

This satellite will overcome some of the limitations of the Satellite for Earth Observation—the launching of which was the first major step in organising space-borne remote sensing systems in the country. The latter satellite was spin-stabilised.

Various studies have already been conducted in ISRO and considerable interaction has also been taking place with the user agencies to define the main features of the proposed satellite.

During 1979–80, efforts will be made towards project definition, report preparation and its approval. Activities will also be initiated towards the completion of a development model and establishment of certain critical facilities.

CEERI's Toroidal Coil Winding Machine

The Central Electronics Engineering Research Institute (CEERI), Pilani, has developed the knowhow for the manufacture of a toroidal coil winding machine.

At present, toroidal winding machines for special purposes are being imported, though indigenously made machines are available for general purposes. CEERI claims its machine's performance is similar to that of the imported ones, and at a significantly less cost.

According to CEERI estimates, Rs 165,000 are required for manufacturing 60 toroidal coil winding machines per year. Out of this, Rs 85,000 will constitute fixed capital (excluding land and buildings) and Rs 80,000 will constitute working capital.

All capital equipment and raw material required for manufacture of these machines is available indigenously.

CEERI, however, does not advise new entrepreneurs to start their venture on this product alone, as the demand for these machines is not expected to be very high. It would be better for existing machinery manufacturers to take up this as an additional item and reduce the need for additional machinery investment.

For details of knowhow transfer, or other information, contact: National Research Development Corpn of India, 61 Ring Road, Lajpat Nagar III New Delhi 110024.

Computerisation of Foreign Trade Data Recommended

An official committee has suggested to the Union Commerce Ministry that it should go in for computerisation of foreign trade data to expedite data compilation.

The Commerce Ministry, in turn, has referred this suggestion to the Department of Electronics. It has requested the department to give a report on the implication of introducing computerisation on the staff of the Directorate-General of Commercial Intelligence and Statistics—the official agency responsible for compiling foreign trade statistics—at the earliest.

The committee which has recommended computerisation, was set up last year to suggest measures for the expeditious compilation of foreign trade statistics. It was lead by the director of the Central Statistical Organisation.

At present, the process of data compilation is very slow and this has adversely hit import-export planning on a scientific basis. At times, this has also hampered trade negotiations with various countries.

Plans for Launching INSAT-II

India proposes to design and fabricate a second-generation INSAT (Indian National Satellite-II), gaining experience from the launching of INSAT-I.

INSAT-I will be designed and fabricated abroad. It is expected to be launched from there sometime in 1981.

Before building a complex operational satellite like INSAT-II, the Indian Space Research Organisation will build an experimental test spacecraft (proto-INSAT), to test the operational indigenous INSAT-II spacecraft configuration and performance.

The INSAT-I is a multi-purpose satellite system for telecommunications and meteorology, and has the capability for TV broadcasting. It provides for countrywide long-distance telephony, weather observation, data collection and disaster warning.

The space segment of the INSAT-II system is being established by procuring from abroad two multi-purpose satellites to be launched in the geostationary orbit. The programme envisages operationalisation of the system in early 1981 with the launching of INSAT-I.

Meanwhile, the master control facility (MCF) centre for the satellite is being established in Hassan in Karnataka. It will consist of two fully steerable antennae with high tracking capacity. The MCF is scheduled to be commissioned by October 1980.

IETE Holding Workshop on Television Technology

The Institution of Electronics and Telecommunication Engineers will hold a workshop on Television Technology on 22nd and 23rd November, this year. Further details regarding this workshop can be had from IETE Delhi Centre, C/o 2 Institutional Area, Lodi Road, New Delhi 110003.

The date for the 23rd technical convention and exhibition of IETE has also been changed. Earlier scheduled to be held in mid-December 1979, the convention-cum-exhibition will now be held from the 12th to 16th January 1980.

Mr Bharwani Passes Away

Mr Bharwani, proprietor of Navbharat Radio Agencies, Bombay and acting president of the western zone of the All-India Radio and Electronic Association, passed away on 11th September 1979. He was 56.

Starting his career as a dealer in radio sets and components in 1949, Mr Bharwani soon turned into a pioneer in the manufacture of do-it-yourself electronic kits. At present kits manufactured by his company are benefitting students all over the country vastly.

CMC Organises Minicomputer Seminar

The Computer Maintenance Corporation Limited is organising a minicomputer seminar at its Delhi office on the 27th and 28th of November, this year.

This seminar will give a general introduction to the power and capabilities of minicomputers. It will also provide a comparative evaluation of the different minicomputer systems available in the market today.

And Abroad ...

Britain Develops World's First Hand-Print Computer Terminal

A computer terminal which will allow untrained people to feed hand-written information into a computer or communications system has just been developed in Britain.

Called Micropad, it is the world's first computer terminal which can accept and recognise hand-printing with either ballpoint pen or pencil.

The desk-top terminal, which is smaller than a portable typewriter, has its own microprocessor which recognises each hand-written character, converts it into a code and transmits it to the main computer. Any written material can be fed into a computer in one step without the need for an operator or typist.

With the aid of such a terminal, hospitals can register patients direct from the out-patient or casualty department's notes, supermarkets can check-in goods direct from the unloading bay, stock brokers can originate their own contract notes, and factory storekeepers can keep more accurate control of stores.

People sending telex messages can also write the message out on Micropad and key it directly into the telex system.

Flat Tube Pocket TVs—A Growing Craze

Believe it or not! Sinclair Radionics, a small British electronics firm has come up with a paperback-sized television set only 1.8 cm thick, with a 7.5 cm black-and-white screen. The TV took two years and $1.5 million to make.

Development of flat TVs is the new craze abroad. In fact, though Sinclair's model has adapted the old cathode-ray tube to its small size, a number of Japanese TV giants, such as Sony and Hitachi, have demonstrated flat-screen TV sets using exotic new displays (liquid crystals, thin-films of transistors etc). The cost of production of these is formidable, prohibiting commercial production.

Sinclair's trick is to squirt the electron beam creating the picture in from the side instead of the back of the set. The beam is focussed and steered in the normal way. But instead of passing in a straight line through the tube, the beam is deflected through a right angle by a powerful electric field onto a phosphor screen placed on the side. The viewer sees the picture exactly as it is beamed onto the phosphor screen.

In today's sets, the picture is transmitted by the phosphor screen through the thick and specially-coated glass screen of the ordinary tube. Thus, Sinclair's new model gives a brighter picture. It is also claimed that it uses less power.

Sinclair's problem now is—how does commercial production of the flat tube begin. Sinclair is in no position to do so as it lost last year on sales. Other TV and industrial tube manufacturers are also reluctant. The reason: Sinclair wants to market the complete tube for under $200 and the tube manufacturers are not optimistic about being able to manufacture Sinclair's new tube (and make a profit) for under $ 100 wholesale.

The day when you may hang a TV set on a picture railing, turning it over when not in use to display a painting, could well be far off.

French Exhibition to be Held in March

The twenty-third Salon International Electronic Components Exhibition will be held in 1980 from March 27th to April 2nd.

Participating in the exhibition will be manufacturers from around the world of electronic components and sub-assemblies, electrical and electronic measuring instruments, materials and products of special interest to the electronics industry, and equipment for the manufacture and installation of electronic components.

The twenty-second Salon exhibition held earlier this year brought together 1383 exhibitors from 31 countries.

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SRB1520	SRB1520R		200
SRB1540	SRB1540R		400
SRB1560	SRB1560R		600
SRB3005	SRB3005R	30	50
SRB3010	SRB3010R		100
SRB3020	SRB3020R		200
SRB3040	SRB3040R		400
SRB3060	SRB3060R		600

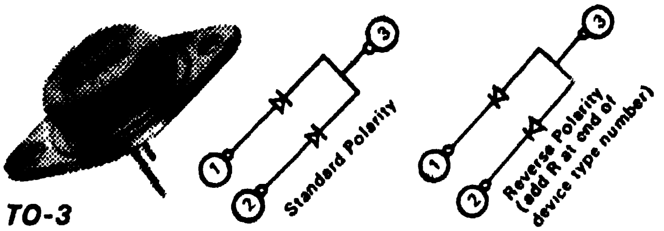
**The TO-3 "Case" will be common cathode for Standard polarity and the "pins" will be anodes of the individual diodes. For reverse polarity, add "R" at the end of the type number. For such devices, the "case" of the TO-3 will be common anode and the pins will be cathode of the individual diodes.

*This is the total average current through the load.

NOTE: 1. Only one TO-3 device is needed for a centre-tap transformer. Hence mounting is easy, inventory is low and easy to maintain.

2. Only two TO-3 devices (on their individual heatsinks) needed for full wave bridge without centre-tap transformer.

3. Similar devices can be put in parallel arrays. Factory matching is offered.



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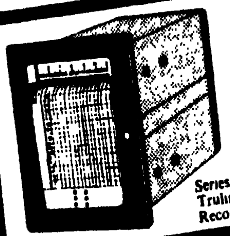
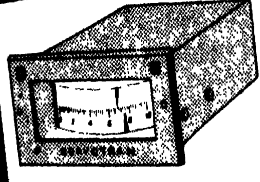
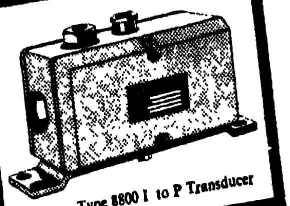


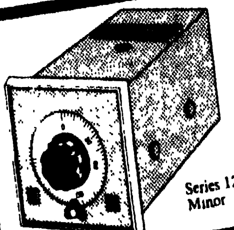
Series 4400 Truline Recorder



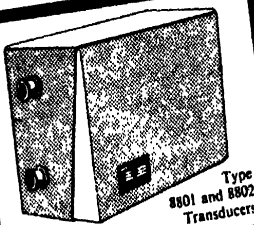
Series 1100 Servotran



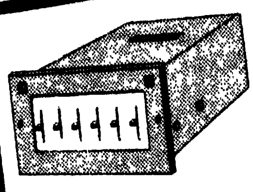
Type 8800 I to P Transducer



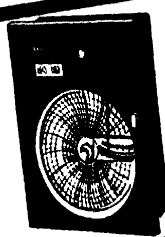
Series 1200 Minor



Type 8801 and 8802 Transducers



Selector Switch



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LETTERS

METRONOME

In re-drawing the circuit diagram of the Metronome (EFY Sept'79, page 71) the 2M, 200 k and 56-ohm resistors have been wrongly marked as R1, R2, and R3 instead of R_A, R_B and R_C Also the 2 μF timing capacitor should have been marked C_1

EDWIN FARIA
Goa

AM TRANSMITTER

Base biasing of AC127 of the AM transmitter by Neeraj Sharma in the August 1979 issue is missing. I also request the author to give the impedance of the microphone used in the input.

PRADIP KARMAKAR
Chandigarh

Mr Sharma replies:

In this circuit there is no need for a separate base bias, as the base bias here is provided by the input signal.

The impedance of the microphone is around 1k, but this is not critical. I myself used a crystal mike.

MANUAL AC MAINS REGULATOR

The input and output selector switches in my construction article on Manual AC Mains Regulator in the July'79 issue have been wrongly drawn. Only terminals 1,2,3 and 6 are to be commoned at input side, and 4', 5', 6', only at the output side of the selector switch.

D.VENKATASUBBIAH
New Delhi

PLEASE PUBLISH

I would request you to publish a circuit diagram and other necessary details for making a pocket radio circuit with an IC.

S. BANERJEE
P.O. Bally

☐ I am interested in a circuit diagram with component details for a fully transistorised voltage stabiliser circuit (modern type).

Dr N. SIVARAMAN
Trivandrum

HELP THROUGH EFY

It is very thoughtful and helpful on your part to have started the 'Help' feature.

Please let the answers to the queries be given through those columns only instead of direct correspondence because thousands of other readers are also interested in the answers as they may have similar problems.

R.K. MATHUR
Jamshedpur

HELP

Licence For Hobby Components

I would like to know as to where and how I might obtain an import licence for small hobbyist components. I need them for myself and not for the purpose of sale. Whoever replies, will be gratefully thanked and his postage expenses will be certainly paid. Vibhu Mittal, Ciba-Geigy Research Colony, Bombay 400063.

100k Mini Volume Control

Where can I get a 100k mini volume control switch used in mini transistor sets? I require it for replacement in a 'Hitachi' transistor set.

If this value cannot be obtained in this size, can anyone suggest as to how I can use a 10k volume control switch in this size which is readily available in the market. R. Sridharan, 2/28, G. No. 6th Street, Jogupalayam, Uboor, Bangalore 560008.

Radio Dial

I require one glass dial for my mains radio 'Murphy Minx' model number TA0824. I am prepared to pay the cost and the forwarding charges. R. Kanthimathy, 10 Thalavai Swami Koil St., Authoor, Tamil Nadu 628151.

Making of LCD Wristwatch

I have two liquid crystal wristwatch displays, type TA8047. If anyone can help me construct a digital wristwatch using the above display, successfully, I shall be glad to give that person one of the displays. M. Kaleemulla, C/o Mandalappay Industries, Chuna Tannery, Kadugonadanahalli, Bangalore 560045.

Output Balance Indicator

It would be of great help to me if somebody could supply me with a circuit of an output balance indicator using two LEDs (without using IC) for a 60W stereo system. Nilkrishna Mandal, D.M. College of Science, Imphal, Manipur 795001.

Kits for Digital Clocks

We have started an electronic club wherein we have tested various electronic circuits published in EFY. We are at present in search of agencies who can supply us kits for digital electronic clocks. G.S. Singh, Asst Programmer, EDP Centre, Administrative Building, Bokaro Steel City 827001.

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S-100 BUS
—The most successful computer bus in history

Kalya

When the first computers were built they were big; big in size and big in cost Since then, over the last four decades, the development of computers has moved in two main directions. On the one hand, the big computers have remained big in size and cost, but their computer power has grown to incredible dimensions. On the other hand, the computer power of each year's computer has become available cheaper the following year.

Both tendencies have continued almost without interruption. However, about five years back the second tendency broke through a very interesting barrier. For the first time computers became available at a price which could be afforded by the ordinary man; they came down to the price of a car!

Undoubtedly, the microprocessor was the key to this breakthrough. But although the microprocessor was the result of a normal development of silicon technology, a very happy incident occurred that is changing the structure itself of the computer industry: the introduction of the S-100 bus.

When reading American computer magazines one very often comes across the term "S-100 bus compatible," or "Altair bus compatible." Over the last four years this bus structure has grown into an industry-wide accepted standard for small computer systems. The growing popularity of the S-100 bus has even been recognised by America's highly reputable IEEE (Institute of Electrical and Electronics Engineers), which is now working on a standard for the S-100 bus, labelled IEEE Task 696. 1/D2. The importance of this fact can well be appreciated by comparison with the HP-IB (Hewlett-Packard Interface Bus) which links digital instruments with computers and among themselves. It was given official recognition by the IEEE under the name IEEE-488 bus, and is now almost universally accepted as an international standard.

The S-100 bus, however, lacks the advantage of a big company name behind it. It was created in the middle of 1974 by MITS, a small company located in Albuquerque, New Mexico (USA). The company designed its first microcomputer system in 1974, the 'Altair,' which was introduced to a large audience through an article in the January 1975 issue of 'Popular Electronics.' The response to the system, which could be bought in kit form, was overwhelming. MITS, who had anticipated manufacturing 800 units in the whole of 1975, found themselves already meeting orders for 1500 units a month by May 1975.

This incredible success was partly due to the enormous

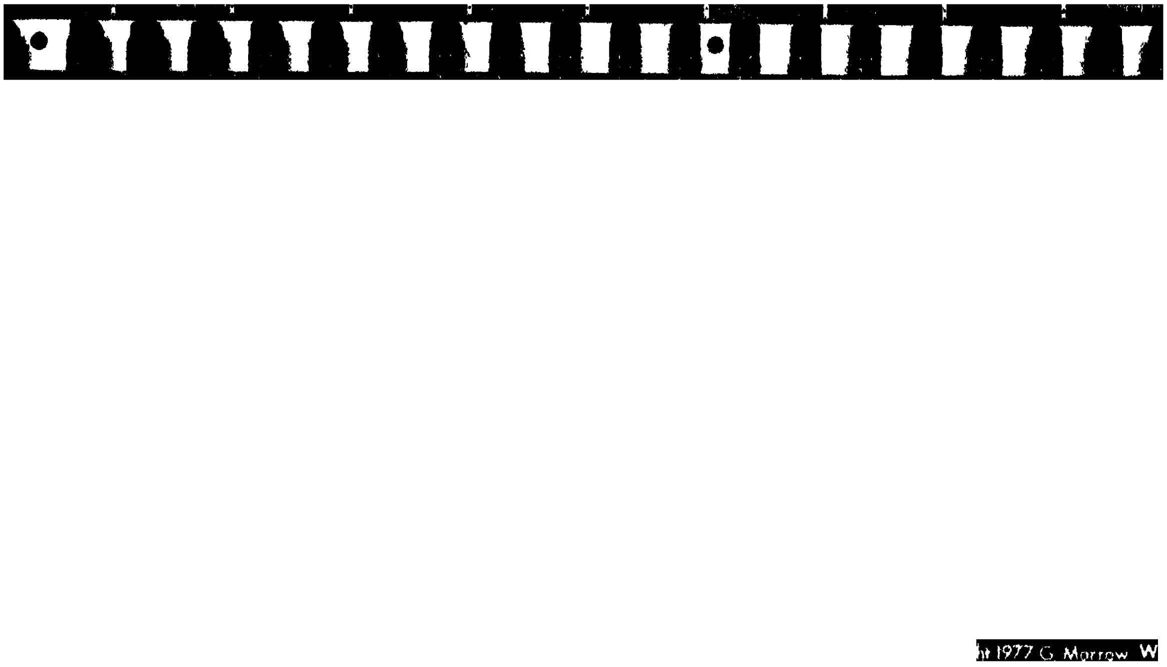


Fig.1: A typical S-100 bus mother board, from 'Thinker Toys' It can accept twenty S-100 boards.

flexibility of the bus, but also to the fact that all signals were given a very precise definition, based on the 8080 signals, which was freely publicised by MITS. This wise move can be compared with Philips equivalent move in the early 60's when introducing the audio cassette. (Philips, rather than patent its cassette, made public a very precise engineering drawing,permitting everyone to be 'Philips Compatible,' and this worked to the ultimate advantage of Philips.)

Other manufacturers quickly realised that the opportunity was perfect to enter into the computer market with a low initial investment (some make only one kind of boards) while having a continuously growing market. So before the end of 1975 a number of companies were already proposing 'Altair bus compatible' systems and cards. At that point the name was changed to S-100 bus, referring to the fact that there are 100 lines on the Altair bus.Today, more than 100 companies of various size are offering S-100 bus compatible products, which is certainly a record for any computer bus.

As it stands now, memory boards for the S-100 bus can provide up to 32k byte static RAM; up to 256k byte dynamic RAM; and up to 32k ROM/EPROM. With the bank select facility supported by some manufacturers, up to 16 megabytes can theoretically be addressed. Board access is as low as 250nsec, allowing a 4MHz Z80 to run without wait states.

I/O boards for the S-100 bus are available for all kinds of floppy disks—single or double density, single or double side, 13.3cm or 20.3cm diameter, hard or soft sectored. Also available are hard disk controllers, mag tape controllers, memory mapped video and graphic displays, all kinds of interfaces for all kinds of printers, as well as interfaces for paper tape and card readers and punches, EPROM programmers, modems, audio cassettes, keyboards, digitisers, plotters, A/D and D/A converters, AC mains controllers and even speech synthesiser and speech recognition.

Although the bus was initially designed to be supported by 8080 microprocessors, the wealth of support available in the form of memory and I/O boards quickly prompted manufacturers into also designing CPU boards around other CPUs. Now the S-100 CPUs include the following microprocessors:

Intel's 8080 and 8086 (16 bits); Zilog's Z80; Motorola's 6800 and 6809; MOS Technology's 6502; Signetics's 2650; Texas's TMS 9900 (16 bits); DEC's LSI 11 (16-bit microcomputer compatible with PDP 11) and others.

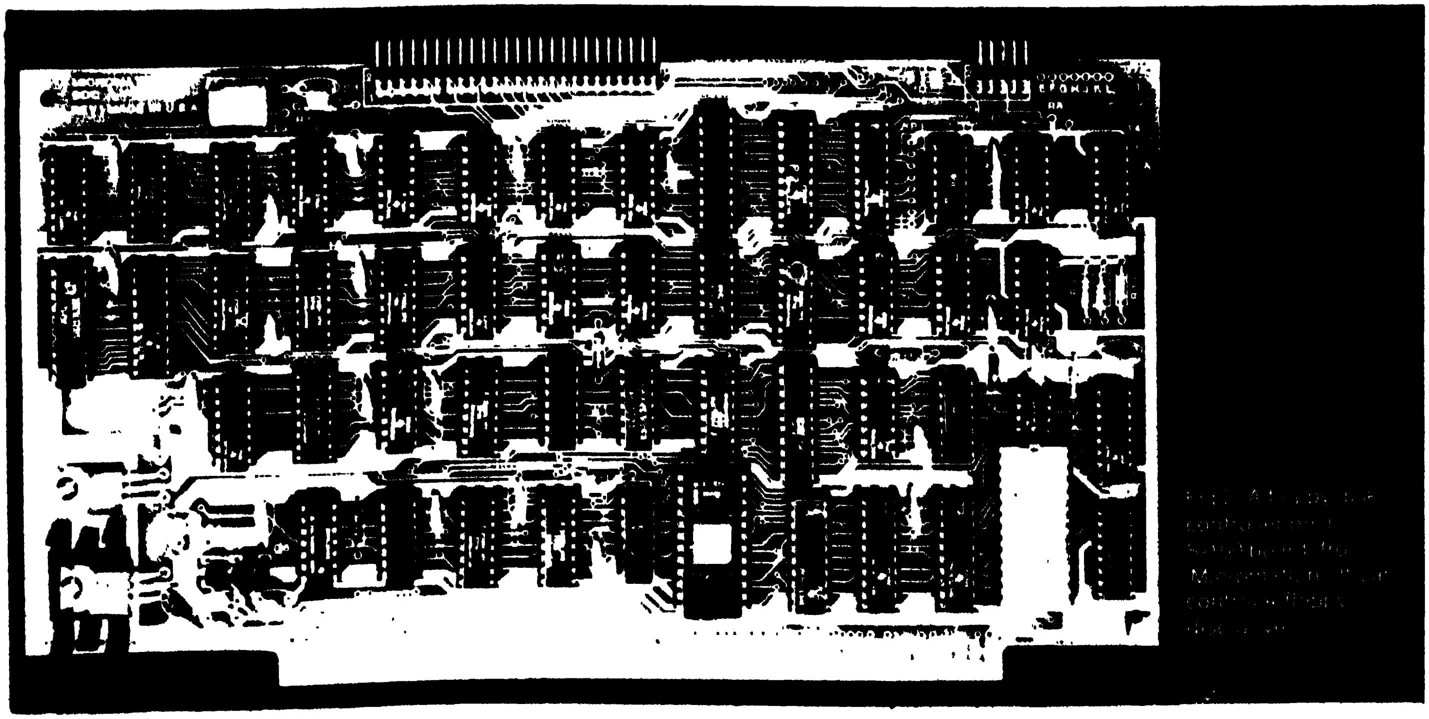
Finally there also exist simple interfaces to connect the very popular Radio Shack TRS 80 and Commodore 'Pet' to the S-100 bus.

Who are the users of these S-100 bus systems? It appears that two kinds are predominant. One is the serious hobbyist who has outgrown the cheaper but more limited 'Under $ 1000' systems such as the Pet and TRS 80. The other is the small companies that find they can obtain more freedom and more computer power through the S-100 than by renting out time on big mainframes. A number of companies (like Imsai, Cromenco, Ohio Scientific and others) who have recognised this fact are already selling complete systems for as little as $ 6000 to $ 14,000 with matrix printer, video terminal, one to four floppy drives, etc. to small businesses in the United States.

A typical S-100 bus-based microcomputer could have the following configuration:

—Alphanumeric keyboard

—CRT display (an ordinary television or a video



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monitor) with 16 lines of 64 characters or 24 lines of 80 characters.

—Floppy disk drive (s)

—Printer

Supported by the following boards:

—CPU (central processing unit, the actual computer)

—CRT controller

—Floppy disk controller

—I/O board (for keyboard and printer)

—One or more memory boards (normally 16k bytes to 64k bytes)

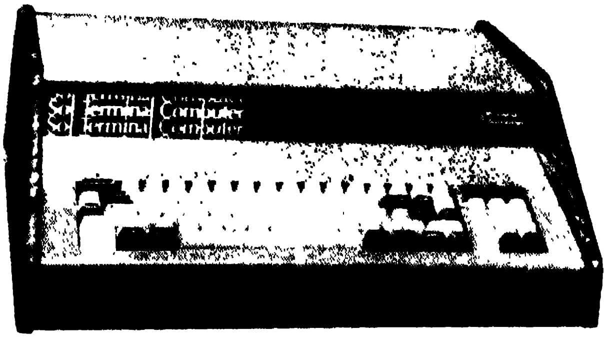
Fig.3. A powerful personal computer built using the S-100 bus, the Sol from 'Processor Technology.' The top of the computer accepts a video monitor.

—Sometimes a ROM board, if ROM is not available on the CPU board

The difference between a 'Personal Computer' and a 'Business Computer' becomes more and more hazy as prices continue to drop.

The main difference however lies in the type of peripherals being used. The personal computer enthusiast usually restricts himself to a low-cost CRT (e.g. TV monitor with 16 lines of 64 characters), mini floppy drive and eventually a slow matrix printer (40 or 80 characters/line), while in a small business environment high-speed line printers, two-to-four 20.3cm floppy drives, high-quality CRTs, and 48 to 64k bytes of memory is required.

The range of prices is usually from less than $ 1000 to $ 10,000.

Without software, a computer—micro or macro—is just an expensive piece of furniture. But fortunately a wide range of software is available that will run on S-100 bus systems. Typically, the system software includes:

—a DOS (disk operating system); CP/M DOS is a popular example for 8080 type of CPUs

—Time-sharing software packages

—Utilities like Editor, MACRO assembler, PIP (peripheral interchange programme), Self-diagnostic programmes

—Disk based higher language, like BASIC, FORTRAN, COBOL, PASCAL, FORTH, C, ALGOL, etc.

As practically all major higher languages are well represented, the type of application programme to be executed in a S-100 microcomputer system is basically limited by the inherent speed limitation of the CPU chip. However where high speed is not a problem, a S-100 system might well replace a minicomputer at typically 1/5th of its price.

The main application areas for a S-100 system are currently found in:

—Accounting

—Inventory

—Word processing (e.g. the electronic office)

—Report generating

—Data preparation

—Remote intelligent terminals

—All kinds of process control

—Sophisticated games simulations like chess, draughts etc.

This quick review of the S-100 bus has been compiled to highlight the importance the bus could play in Indian computer development. Undoubtedly, many Indian companies can widely profit from an affordable flexible computer system.

The role the S-100 bus can play towards this end is significant: the S-100 bus exists and is already widely accepted throughout the world. Therefore any manufacturer willing to enter the market does not need to develop a computer system from scratch, but can concentrate on only one board and be sure of its acceptance. This removes entirely the monopoly of small computer manufacturing from huge corporations, and puts it within reach of the smaller, technology-oriented, electronic manufacturer, such as found in India, and presents a happy opportunity for S-100 bus compatible systems to appear on the Indian market.

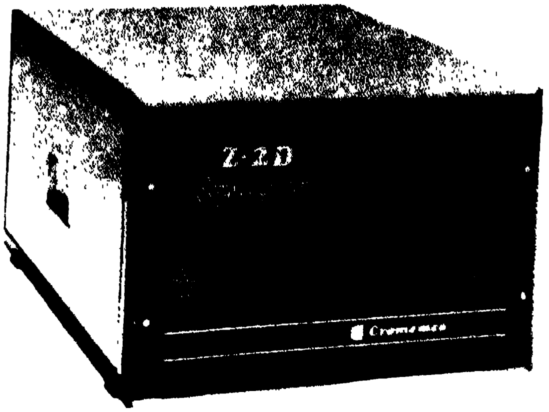

Fig.4: A powerful business computer built using the S-100 bus, the system Z-2 from 'Cromenco,' in standard 48.3cm rack.

Their adoption could certainly enable India to leap frog over many otherwise time-consuming stages of development in computer systems and bring customised computer power within reach of most scientific and business enterprises. They will enable India to come rapidly to grips with the growing needs of national and international commerce. □

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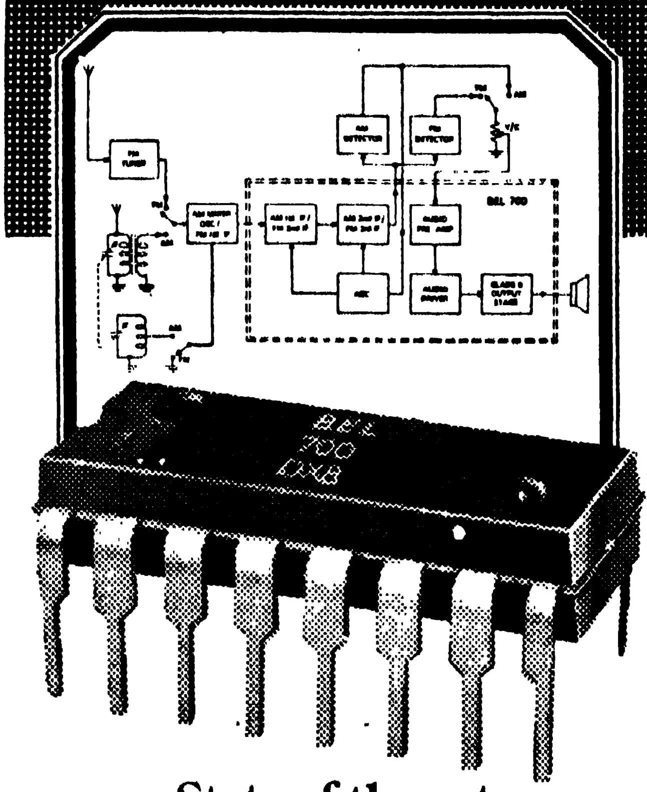

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PROTECT YOUR ALARM
by automatically silencing after a preset delay

D. Venkatasubbiah

Alarms of various types are nowadays getting popular for use at homes, offices, industrial and commercial establishments and in automobiles. But after they start wailing few can silence automatically after a predetermined time.

Continuous sounding of an alarm for a long time, whether due to negligence or absence of the person who is supposed to switch it off, can damage the alarm. Most alarms are designed for a few minutes operation only. It is therefore advisable that a protective circuit may be used for automatically silencing an alarm after it has sounded off for a predetermined period. The circuit given here can switch off an alarm after a predetermined period of up to five minutes.

Working

When the alarm circuit is activated, the alarm voltage appears at the point 'y'. In the normal case, the alarm (loudspeaker, bell or horn etc) is connected at 'y' and operated directly. But now let us see the contribution of the additional protective circuit connected inbetween.

Initially, capacitor C1 is in a discharged condition and behaves as a short when the voltage appears at the point 'y'. Therefore, the base of transistor T1 gets the alarm circuit's full output voltage and is forward biased. When T1 conducts, it in turn drives T2 to conduction and saturation. Thus, the relay R and the alarm get supply as soon as the voltage appears at 'y' and operate normally, just as they would have without the intermediary protective circuit.

Now C1 starts charging through R1 and the voltage across R1 falls exponentially. After the delay, which is determined by the product of R1 and C1, this voltage falls so low that T1 can no longer conduct, and the alarm gets switched off. The circuit stays in this state until the alarm circuit is reset again for reuse.

Resistor R1 and diode D1 provide discharge paths for the capacitor C1, when the alarm is reset. Diode D2 provides reverse bias to transistor T2 so that there is no false switching due to small (transient) voltages.

Practical hints

1. Short points 'y' and 'z' as shown by dotted lines in the circuit diagram. Otherwise, short points 'x' and 'z' instead of 'y' and 'z'. In the latter arrangement, loading on the alarm circuit is reduced. In the former arrangement, the whole circuit can be viewed as an integral part of the alarm itself and does not need the third connection to the DC power supply.

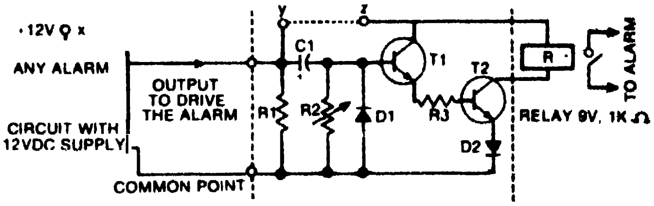

Fig 1: Alarm disabler after a preset delay

2. The circuit arrangement assumes that a relay is used in the alarm. In case it is desired to operate a horn or any other alarm which works directly on the same DC supply, the voltage at the collector output of T2 can be used to drive it through a suitable buffer stage.

3. The circuit is shown to work with +12V. It can be adapted for any other voltage.

4. If one needs a delay of more than five minutes, the value of capacitor C1 may be increased.

PARTS LIST

T1, T2—BC109C (BEL) transistors
D1, D2—CD32 (CDIL) diodes
C1—250μF, 12V electrolytic capacitor
R1, R3—4,700-ohm, 1/4W resistors
R2—500,000-ohm potentiometer (trimpot)

□

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An Insight Into OPTICAL COMMUNICATIONS SYSTEM

Lt. Col. Pran Nath

In the wake of accelerated developments in the field of technology new systems of communications are born every few years. From the days of Marconi when the radio waves were trapped, to the current days when solidstate devices and miniaturisation is the order of the day, technicians, scientists and engineers are constantly endeavouring to create new vistas of technology. The reason for this is not one but a combination of many, and most of these have a bearing on the technological infrastructure, trade potential and economy of a country.

Whenever an idea is born, there is an effort to give it a practical form. One such case is of using modulated light guided in glass fiber, used as a media for broad-band communications. The idea initially took shape as an offshoot of analysis of propagation in dielectric guides. The initial experiments showed that it was possible to have a classical waveguide propagation in glass fiber with suitable refractive indices and dimensions.

In this article we will discuss the optical communication system (OCS) which is presently at the threshold of commercial exploitation in the USA and the UK.

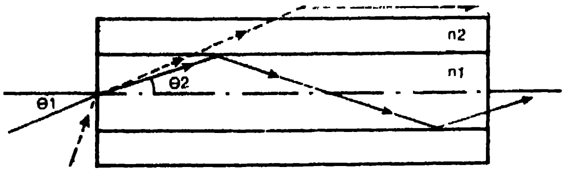

Fig 1. Optical waveguide ray path

Communication system requirements

There are a few basic requirements of a communication system. These are:

1. To convert sound and telegraph signals or both into electrical signals.
2. To convert electrical signals into higher frequency signals, for ease of carrying through the media proposed.
3. A suitable media with the least possible attenuation.
4. Repeatering, in case the transmission losses are high or distances are long.
5. Detectors to convert the signals into the basic form of intelligence at the far end.

These requirements are equally applicable to the OCS as well. The OCS requires transducers to convert the electrical signals into modulated light. It also requires a propagation media, which is glass fiber strand in this case, and a detector to convert light signals back into the electrical signal at the far end. Repeaters may also be necessary when propagation losses are excessive.

System configuration

The building blocks of an OCS are given in Fig. 2. All systems have essentially the same configuration. Where they may differ would be in the nature of the dotted blocks: In a simpler system the blocks shown in dotted lines may not be present at all.

The transmitting source in each case is a laser and receiving device a photodetector. Generally amplitude modulation is used. But where power involved is large, pulse position modulation or pulse code modulation may be used. Where pulse code modulation is used, additional circuits in the form of amplifiers, reshaping and retiming networks would be necessary.

The repeater amplifier is a critical sub-system. Although conceptually it is simple, its construction is extremely difficult. The problem lies in converting light signals into base band for the purposes of repeatering. The devices and circuits which can amplify modulated light signals without going through base band conversions are the subject of investigation today. In the meantime low-loss fibers are being invented to obviate the necessity of repeatering.

Technical details

The optical fiber can be considered as a waveguide media for transmission of wideband signals. The terminations are a source of light at one end and a transducer at the other end to convert light energy into signals. As in a waveguide, the optical signals in a fiber travel by reflection from the medial walls (Fig 1). Total reflection takes place in a fiber media with refractive index n1 which has a boundary with a media of refractive index n2, when n1 is greater than n2. The light signal has to be launched into the fiber at a predetermined angle, or else it will not propagate through it.

An LED is a common source of light. When placed close to the optical fiber it generates signals with multimode properties (Fig. 3).

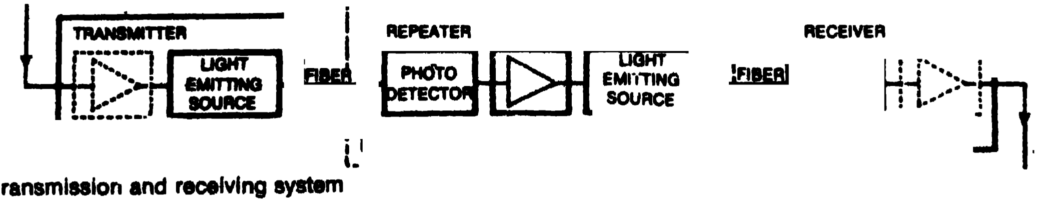

Fig 2. Basic fiber transmission and receiving system

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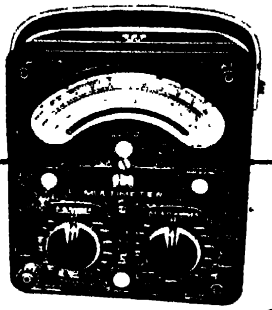

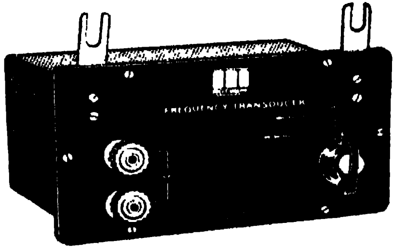

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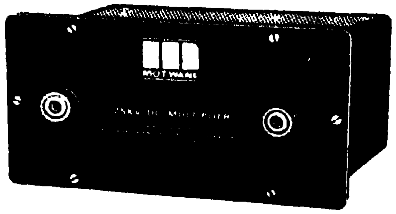

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Propagation of light

There are certain basic technical considerations which control propagation of light through an optical fiber. These are:

1.The diameter of active source should not be greater than that of the optical fiber, otherwise losses will occur.

2.Monochromatic laser sources are very few.Therefore, the optical fiber should be such that it is capable of multimode propagation.

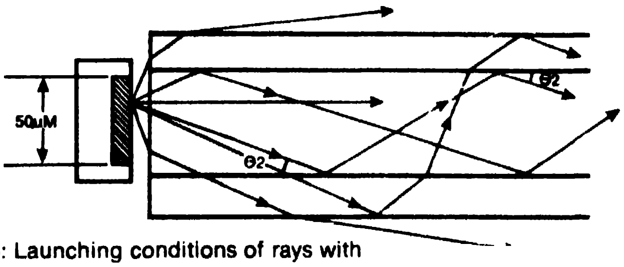

Fig.3: Launching conditions of rays with a LED into multimade fiber

3.Bandwidth capability of a high numerical operture fiber is less than that of one which is able to have fewer modes.

GaAs laser is another light source. The optical fiber material for single-mode propagation uses doped silical for core and pure silical for cladding.

Types of lasers used

Semiconductor lasers are ideally suited as source for wideband optical communication systems. These lasers are known to give 10,000 hours of continuous wave (CW) operation. Lasers which can work up to 10^5 hours are under development. The basic considerations for laser design are wideband, high-power output, high modulation efficiency, narrow spectral line width, and narrower emission pattern.

The geometry of a SiO_2 laser is shown in Fig. 4. The conventional junction structure is double layers with Ga, Al, As passive layers with 35% Al and an active region with 5% Al. With this type of junction structure CW operation is attainable at 353 k.

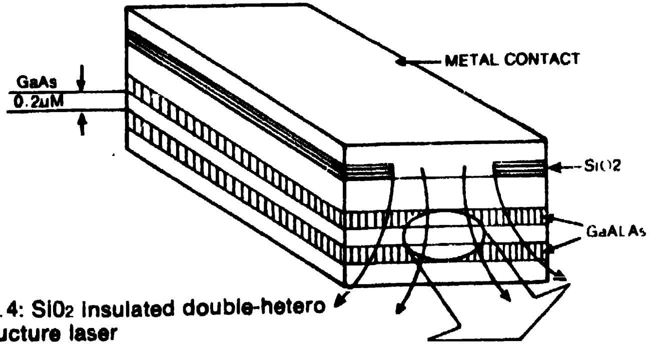

Fig.4: SiO_2 insulated double-hetero structure laser

As regards reliability of lasers, their short life is mainly due to the formation and growth of dark line defects or related effects.The dark line defects are areas which appear dark when the laser is operated spontaneously. These can be viewed with an infra-red microscope. Efforts are on to rid the laser of defects and improve its reliability.

Design of an optical fiber cable

The more important components of an optical fiber cable are:

- Coated optical fibers
- Tensile reinforcement
- Radial reinforcement
- Sheath
- Moisture barriers
- Insulated metallic conductors and screens
- Core wraps
- Filters

The simplest structure is of course a single coated fiber with sheath. For tensile and radial reinforcement, additional components are necessary. This can be achieved by adding filling material all around the coated fibers. Control power is inserted by including metallic conductors, whereas core wraps are meant to maintain the geometric uniformity in groups of fibers and conductor.

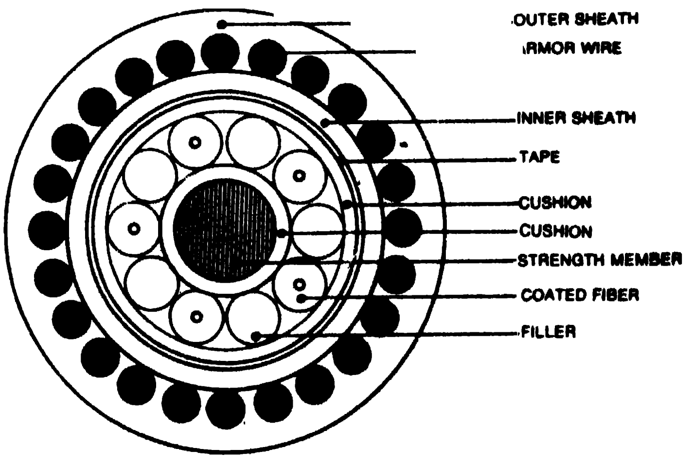

Fig 5: Structure of an optical cable

A typical construction of an optical fiber cable is shown in Fig. 5. It will be seen that with the various components added to the cable structure, it is considered important to retain the fiber in a fixed geometrical condition in spite of stress and strain. The transmission capabilities of optical fibers are such that only a few fibers are required to carry many channels and, therefore, strengthening structures are predominently more in number.

From considerations of channel capacity, the light signals have a frequency of about $3x10^8$ MHz. Therefore, the bandwidth and hence the information carrying capacity is very large as compared to other systems like coaxial cables or waveguides or even the microwave communication systems using space-wave propagation. In order to withstand a possible competition with other systems, the OCS offers certain special features.

First,the OCS, being in the light band of frequencies, has a very large bandwidth of the order of 300 MHz. This bandwidth is adequate to carry up to 1920 speech channels.

Second, the glass fiber used is very thin—sometimes as thin as a human hair. It is formed into cables with protective insulation and other conductors for power supply and order-wire facility. The diameter of the cable, in such a case, does not exceed 7 mm. This gives it the advantages of low weight, small size, flexibility and ease of installation.

Third, the glass fibres have negligible crosstalk levels, and are not affected by external spurious radiations. They are, therefore, immune to interference of any type. Their own radiation level is also low enough. Therefore, they do not cause any interference to nearby systems.

Fourth, the optical cable, once laid, is immune to tapping and interception by unauthorised personnel as it is extremely difficult to cut the cable for this purpose. Also the system uses pulse code modulation and is, therefore, highly secure against evesdropping.

While all this is being said about the OCS, scientists and engineers are making an all out effort to bring down the cost per km per channel of the system. They claim that a system under development cannot be presently compared, costwise, to a well established system like a coaxial cable system. They are quite confident that in case commercial exploitation of the system is resorted to in due course, their costs will be far below the costs of other communication systems.

An experimental system

We have learnt that a 9km experimental OCS route is being laid between Stevenage and Hitchin, about 32 km north of London. The system is capable of carrying 1920 telephone conversations or a mix of telephone, TV, and data traffic between the two stations. The system carried 140 M bits/sec pulse code modulated digital transmissions over a 7mm diameter optical fiber cable. The cable is routed through the already existing ducts of the British Post Office to determine its interference potential. The terminal multiplexing equipment for this route has also been designed and the stream of electrical pulses from the fiber cables is converted into infra-red beams by tiny lasers connected to the end of each fiber. Optical repeaters are sited at 3km intervals down the route.

Although an experimental system, it may prove to be another breakthrough in the technology to solve the system designers' ever increasing problem of clearing high-density traffic within crowded cities and across them.

Other possible applications

Other applications of OCS are in industrial organisations, public utilities, and military users.

In the industrial and public utilities field the OCS can provide colour TV channels and interference-free electromagnetically compatible electronic systems in ships, aircrafts, factories and along railway tracks.

From military users' point of view it can be a lightweight, interference-free, secure long- or short-hop system which can easily replace radio links. Intercommunication systems in areas which need to be safeguarded can also be provided. ☐

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ROBOTRON: COMPUTERS AND BUSINESS MACHINES FROM GDR

Robotron's head

The direction and rate of economic growth depend to a great extent on the level at which electrical engineering and electronics are used in industry and economy and in other non-industrial areas

The dynamics of scientific and technical progress plays a key role in this respect. This is reflected by formation of large, efficient industrial combines.

In the German Democratic Republic (GDR), the entire production process, from research and development, production and sale of electronic computer technology and business machines is under central management.

VEB Kombinat Robotron supports and represents this important branch of economy by fusing all production capacities in this field into a unit, thereby giving it a new dimension of quality. As the most important industrial combine in the GDR, Robotron comprises twenty-one noted enterprises, which have already established a good name for themselves in the production of electronic hardware and system software for economic units of various sizes.

There are roughly 70,000 highly qualified workers, engineers and scientists behind the 'Robotron' trademark, which is recognised in the world market. They concentrate their efforts on progressively extending Robotron's range of production.

The current Robotron production programme comprises:

—EDP systems of the ESER series
—small-sized computers, process computers and microcomputers
—automatic invoicing and accounting machines
—data acquisition systems
—typewriters
—Robotron REISS drawing machines
—organisational aids
—electronic measuring and entertainment equipment.

Computers of medium size included in the series production programme of the Robotron combine:

At present, the production programme centres on the EC 1055 EDP system, which is part of the ESER 2 series and whose central processor EC 2655 developed by Robotron meets the highest international requirements.

The development and production of the EC 1055 EDP system is based on the positive experience gathered by the users of the tried and tested EC 1040 system of the ESER 1 series, whose universality and performance in all fields of economy enjoy world-wide recognition.

Electronic data processing systems, MDT and business machines bearing the 'Robotron' trademark are operating successfully in the national economies of numerous countries on five continents.

The basis of Robotron's success is many years of experience in research, development and production of electronic data technology and office machines and consistent cooperation with its partners in the ESER, which stands for the Unified System of Electronic Computer Technology of the socialist countries. VEB Kombinat

Robotron is making an important contribution to socialist economic integration of the CMEA countries by working on certain development, production and application of units, EDP systems and problem solutions of electronic computer technology co-ordinated with other ESER partners

The foreign trade interests of the Robotron combine are represented by the nationally-owned foreign trade enterprise Robotron Export-Import, which is a competent trade partner in the field of EDP and business.

Robotron Export-Import demonstrates the international competitiveness of the highly effective and powerful products of the GDR's data processing and business machine industry by exhibiting at major fairs, trade exhibitions and symposia.

In addition to its comprehensive range of hardware, Robotron's performance profile is also characterised by its user-oriented and specialised range of software. It is important to note in this connection that Robotron Export-Import supplies all Robotron products of electronic data hardware in conjunction with interesting and tried problem solutions. They can be adjusted to various applications and to a wide variety of special tasks in the fields of science, engineering and commerce.

The yardstick that is increasingly being applied to makers of electronic computer hardware is the scope of their software performances. VEB Kombinat Robotron provides individual user consultations, technical and economic project consultations and training of specialists at training facilities operated by the combine. In addition, Robotron also has its own demonstration and test computer centres.

Thousands of specialists from home and abroad are trained at Robotron's training centre each year to operate Robotron systems.

Robotron Export-Import maintains offices and after-sales service centres for its partners abroad as well as an extensive network of well-known marketing organisations and agencies.

Robotron—a trademark as a symbol of efficiency of electronic computer hardware and office machines from the GDR.

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Electronic Data Processing System – EC 1055

On the basis of the arrangement on cooperation between the socialist countries within the framework of the Unified Computer System (ESER) in the development, production and application of modern electronic data processing systems, the series 1 of ESER-based hardware has been transferred to production and backed up by comprehensive software.

The next stages of development envisage the further perfection of the ESER hardware of the series 1 in order to fulfil user demands. At the same time, a new series of ESER hardware (to be known as series II) is to be marketed in the coming years. The principles and concept of the ESER system will be maintained by this new series.

The principal contributions of the German Democractic Republic to the ESER system, series I and II, are the EC 1040 and EC 1055 electronic data processing installations.

Principles and characteristics of ESER series II installations

The aim of the development of the ESER-based models of series II is to incorporate the very latest findings of research and practical experience in the hardware and software of the new equipment.

The operating principles of series II will form the basis for all models. They are based on the main directive formulated in the operating principles of series I, plus a number of new functions. In this manner, better compatibility will be achieved with computers of a higher hierarchy, and new functions can be included to achieve a much wider sphere of application.

One of the most significant innovations of the ESER operating principles for series II is the implementation of the technique of virtual storage. Accordingly, relatively cheap external memory units (magnetic disks) are to be included in the address space (virtual memory) for the programmer, in addition to the working memory. The address space provides an addressing potential of 16M bytes (24-bit addresses).

The memories of these models will be based on new components, and accessory units will be provided for the establishment of multiple computer systems.

Characteristics and design of the EF 1055 DP installation

Model EC 1055 is a computer of medium capacity within the ESER series II. Its principal elements are:

—EC 2655 main frame
—OS/ES-6 operating system
—Peripherals

The main frame is composed of:

—Central processor
—Byte-multiplex channels
—Block-multiplex channels
—Working memory

Robotron EC 2655 main frame with extended system control.

The Robotron EC 2655 main frame incorporates all the necessary functional groups to decode and execute instructions and to control the flow of functions. Various units have been included to ensure that the potential of the main frame is fully utilised. It is ideal for operation by a larger number of subscribers and for joint use of stocks of data.

The Robotron EC 2655 main frame consists of the central processor, the working memory and the input/output system. The central processor performs up to 450,000 operations per second. It is microprogram-controlled and the microprogram memory can be partially loaded. This feature is primarily used by the error routine system.

The working memory is supplied in two configurations having a capacity of 1,024K bytes or 2,048K bytes. It is composed of independent logic modules with overlapping access. In this manner the working memory can be adapted to the specific requirements of given applications. The constructional concept of the memory permits on-the-spot extension of a small memory to form a large one at any time.

The working memory is safeguarded against unauthorised reading and writing operations.

The input/output system of the Robotron EC 2655 main frame is composed of the channel exchange, the channel tester and up to five channels The basic version of the main frame features one byte multiplex channel and two block multiplex channels. One block multiplex channel and one byte multiplex channel, or two block multiplex channels, can be additionally incorporated The use of the 2-byte interface for one block multiplex channel is particularly advantageous because it helps to increase the data transfer rate of multiple computer systems.

The Robotron EC 2655 main frame contains a special facility to emulate DOS/ES in conjunction with corresponding operating-system backing user programs written for DOS/ES can be worked off by the EC 1055 DP system under the controlling action of the further developed OS/ES.

Integrated circuits of the TTL 1 and TTL 2 ESER series in dual in-line enclosures are used to implement the logical functions in the Robotron EC 2655 main frame. The circuits consume little power, have a high processing speed and a short cycle time. The use of multiple-tier circuit boards in combination with the adopted wiring technology guarantees a high packing density of the modules as well as a short signal transit time.

The new ESER plug connectors provide dependable protection of the contacts against mechanical damage which, in conjunction with a novel contact principle, ensures a high measure of reliability of the plug connection.

Robotron EC 7069 control console for communication and maintenance

The Robotron EC 7069 control unit is a constructionally independent item of equipment that is used for communication between the operator and the operating system as well as between the servicing personnel and the computer. The console incorporates all the facilities necessary for controlling and monitoring functions. It can be supplemented by a visual display unit with keyboard and selecting pen The visual display unit has a capacity of 25 lines of 80 characters each. The keyboard is composed of 26 alpha characters, 10 numerical characters and 27 special signs for data entry and for selecting the desired functions.

A variant model of the keyboard features an additional 20 cyrillic characters. The control console enhances operating ease and increases the speed of communication. A serial printer can be linked to the console to print out the information displayed on the screen of the visual display unit. The serial printer operates at a speed of 45 ch.p.s. The Robotron EC 7069 control console is linked to the main frame via the standard interface and via a special interface. Since the control console is an independent item of equipment it can be set up at any point that is best suited for the operation of the EC 1055 DP system. A second control console can be linked to the main frame for special duties or if this is specified by the buyer.

The new OS/ES-6 operating system supports the functional potential of the Robotron EC 2655 main frame so that the user can exploit the full capacity and all possibilities of the EC 1055 DP installation. Problem-oriented software can be made available together with the OS/ES-6 operating system, particularly for application with data bank problems and to support production processes and commercial-mathematical methods.

Possibilities of application of the EC 1055 DP installation

The hardware and software potentials of the EC 1055 make it possible to operate this DP installation in universal computer stations of large enterprises, com-

Robotron EC7069 control console

regional services and large regional administrations Inquiry and data bank systems, information services and booking systems can be very efficiently operated with the help of the EC 1055. The operation of the EC 1055 by dialogue and remote batch processing, also on a time-sharing basis, ensures that the DP installation can be used simultaneously by a number of subscribers, thereby promoting the establishment of community computer centres for joint use. Since the installation can be linked to other large or small computers, an entire hierarchy of computer systems and computer networks can be set up.

A multitude of problem solutions and a wealth of experience gained from the operation of ESER-based hardware of the first series in the GDR have resulted in comprehensive application packages for use in finance, agriculture, the building trade, transport, education, the health service and the electric power industry

Specifications *Central processing unit*

Microprogram store	
capacity	8 K instructions with 65 bits each
cycling time	400 nsec
access time	140 nsec
number of instructions	181
operating speed	450,000 operations/sec
Operating store	
medium	MOS element
extension stages	1,024 K bytes 2,048 K bytes
cycling time	1,200 nsec
call width	8 bytes
store protection	read and write protection
Channels	
number	up to 5
block multiplexers	up to 4
byte multiplexers	up to 2
device control units per channel	10
Transfer rates	
block multiplexer BLMPX 1	1 5 M bytes/sec (1-byte interface) 3 0 M bytes/sec (2-byte interface)
block multiplexers BLMPX 2, 3, 4	1 5 M bytes/sec
byte multiplexer BYMPX	up to 40 K bytes/sec in multiplex regime 1 5 M bytes/sec in selective regime
Number of subchannels	128, 256 for 2nd BYMPX

Operating System OS/ES-6

An improved OS/ES operating system, known as edition 6, has now become available after it was very carefully tested under consideration of the new hardware functions and operating principles of the computer series II of the ESER system. The OS/ES-6 operating system makes it possible to exploit more effectively the potential of the EC 1055 electronic data processing installation which is such a series II model The new operating system can also be used to optimise the operation of the already established EC 1040 installation of the ESER system. Compatibility to higher hierarchy levels is guaranteed for files and programs.

The functions of the previous operating system, OS/ES-4, and the experience gained in its development and use, formed the basis for the development of the OS/ES-6. Virtual storage techniques offer the user significant advantages because they furnish him with maximum address space for the solution of his problems. The virtual store is formed in a direct access memory, and dynamic restoring takes place between the real memory and the virtual memory. In this manner optimal use is made of the real main memory. Only active tasks require the real memory to permit the processing of programs which have a storage requirement that is larger than the existing real memory.

Virtual-real processing enables the user to define the entire working memory, or part of it, as "real". In this way programs that were written for ESER series I computers, and which contradict the conditions of virtual storage techniques, can still be processed. The introduction of the MVS control program configuration offers users a virtual storage capacity of up to 16M bytes.

Job administration is raised to a new qualitative level by the OS/ES-6. The job input subroutine conducts the system input, the system output and the establishment of job chains centrally for all program ranges. The job input subroutine is always resident but does not occupy user program ranges. The interpretation of the job control instruction is only conducted with the start of job processing so that system input currents can be read at top speed. Furthermore, no input/output units are blocked by waiting jobs. A new organisation of job chain files permits unhampered system operation.

Main frame limitation and waiting time limitation will terminate a job in the event of prescribed times being exceeded.

The dynamic test system consists of an interactive system for the localisation and temporary elimination of errors in programs. It permits the display and alteration of real and virtual storage places and register contents, and it will stop programs while certain instructions are being worked off or in the presence of selected events. The functions of the test system are activated by a command language.

An increase of the degree of multiprogramming permits optimal use to be made of the system resources. Consequently, up to 63 assignments and subroutine tasks can be processed in parallel.

The OS/ES-6 system provides a new access method for the organisation and storage of data in the direct access memory.

The principal advantages are:

—Simple use,

—High data throughput rate,

—Comprehensive file protection,

—Central file survey by special catalogues,

—Independence of any specific type of hardware,

—Sequential access to the data via code or direct.

A special access method, as well as auxiliary and converting programs, are available for the output of data on microfiches for direct or indirect microfilming.

Efficient operation and a high level of exploitation of the system resources are achieved by remote processing. The new OS/ES-6 operating system offers the remote access methods and processes for this purpose.

Data Bank Operation System/Robotron (DBS/R)

Problem and basic definitions

Efficient data storage depends to a considerable extent on the fulfilment of the following three demands·

—Rapid availability of the data for the different processing jobs and inquiries

—Low storage space requirements.

—Simple maintenance of the entire stock of data.

Only the storage of data in the form of a data bank will produce a justifiable compromise between the individual assignments which can be somewhat contradictory in their nature.

The programs required for the organisation of a data bank are known in their entirety as a data bank operation system. Data bank and data bank operation system form together, a data bank system.

The data bank operation system/Robotron (DBS/R) was drawn up by VEB Robotron/ZFT as universal software for the first and second generation of computers of the Unified Computer System (U.C.S.) of the Council of Mutual Economic Assistance. It is based on the operation system OE-ES in the MFT and MVT modes of operation. DBS/R consists of the components of the base system and of the remote processing system.

DBS/R operates primarily with structured data which are stored in a fixed or variable format. Storage is record by record as dependent and independent records from which list, tree and net structures can be formed.

The users of DBS/R can be subdivided into differing circles of persons in conformity with the given assignments and qualifications. Three specific languages are available to them for the use of the system. The format and structure of the data are defined by so-called file identifying sheets which represent the data definition language of DBS/R.

Problem-related programs are formulated with the data manipulation language of DBS/R (DBS/R language) and by the customary programming languages. The DBS/R language is a procedural language. The third language of DBS/R, the so-called command language, controls the operation of the remote processing system.

Another fundamental term is the function which, in this connection, is an activity of the data bank operation system that can be called and controlled Calling and control are usually effected by the data manipulation language

Storage structure of DBS/R

Data Units: In conformity with their purpose of application a difference is made between internal and external data units. Internal data units exist within a data bank system, and external data units exist outside the system. The internal data units are field, segment, record and file. These are characterised by the fact that they have been already processed by the EDP installation. The external data units are field, segment record, line, page, image and field. They arise either during the process of collecting or as a result of processing programs. The stock of data administered by DBS/R is subdivided into files.

The input files contain the data which form the stock files as a result of DBS/R storage runs. These stock files are differentiated by their position in the data bank system into data bank files and separate files. A data bank file contains the stored notation of its relationships with other files.

Separate files are files organised in the customary manner, but which use the functions of the data bank operation system. The separate files, therefore, fit in the data bank system and supplement the data bank in a convenient manner. Output files are the result of processing routines and inquiries. They are created during retrievals and as log files during storage. They include printer files, video display screen files as well as files intended for further processing.

Processing with DBS/R transforms the external data element into internal ones. A number of possibilities are open to the user to format external and internal data elements. External data can be collected as:

—Fixed format (fixed relative address related to the beginning of the segment).

—In a fixed sequence (the relative address related to the beginning of the segment is variable, while the sequence of the fields is fixed).

—With field flags as identifiers

Several formats internally envisaged to map the contents of the fields. Fields can be stored in a fixed format, a variable format, and non-formatted Transformation of the external data elements into internal ones causes the data treatment functions of DBS/R to become effective They contain comprehensive testing and converting operations and guarantee far-reaching correctness of the data, both formally and in substance

Logical storage structure The storage structure determines primarily the efficient storage and retrieval of data

DBS/R is based on a storage structure that is adaptable to the concrete conditions of the fields of application. The interaction of the base and connecting files is characteristic of the system

A base file consists of independent data records. Each record of a connecting file establishes a relationship with a fixed number of records of base files or other connecting files

Different structural forms can be formed from the base and connecting files. The following combination possibilities are available:

—Connecting files can be formed between any base file.

—A base file can stand in a relationship with any number of connecting files.

—A connecting file can be used to establish relations between any number of base and connecting files.

Another structural form comes in the form of so-called coupling where a record of a base file is coupled with a record of another base file by corresponding commands. A base file can participate in any number of couplings.

The structural forms are represented by index lists and base address chaining. The index lists make a difference between primary index and secondary index. The primary index uniquely identifies a data record, and it is formed from the main identifier term. The secondary index can be formed for any field of a data bank file. Uniquely defined and ambiguous indexes can be formed. Ambiguous indexes effectly back up queries in data bank files

Address chaining is used to inter-link data bank records This is done by address information stored in the data records The resulting record sequences are known as chains

Chains can be formed according to different aspects In DBS/R they represent the principal means of fulfilling the demands listed under 'Problems and basic definitions' for efficient data storage.

Language concept of DBS/R

Data description in DBS/R: The DBS/R user employs file identifier sheets to describe the relations between the files and the necessary field treatment in the files of his data bank systems The data identifier sheets are input vouchers that can be punched They usually have a fixed format The machine-readable input data are checked by the program package "File Catalogue" for correctness, completeness and freedom of contradictions.The program packages build the so-called data description catalogue from these data. This is the basis of definition as a result of which the data description table (DBT) of a file is produced from the data of the file description catalogue.

DBS/R language: The DBS/R language is the data manipulation language of DBS/R. It consists of a quantity of instructions which fulfil controlling and descriptive functions. The user employs the language instructions to control the functions of DBS/R and to inter-link them. Other instructions describe the output files and define the fields and ranges which handle data exchanging during processing. An instruction consists of a sequence of language terms.

The language term is the smallest semantic unit of the DBS/R language. The sequence formed by the description of several instructions of a complete problem is known as the job or query.

The DBS/R language instructions are classified into different groups by their application and manner of operation. With the exception of the defining instructions, they can be combined in any manner desired.

DBS/R has its own function control which is stipulated by the sequence of instructions of a job The DBS/R language instructions are designed in such a manner that an explicit cycle formation is not possible. This limitation means that a user program composed only of DBS/R instructions will only contain list and tree structures as a sequence of instructions.

This means that DBS/R user programs are simple and conveniently arranged, thus fulfilling a basic demand of structured programming

DBS/R permits the flexible and standard forms of operation in the generation and execution of user programs The flexible mode of operation involves translation and immediate execution The standard mode of operation follows error-free translation results in a loading library It can be called from this library any number of times for subsequent processing. User programs can be written:

—Exclusively from DBS/R language instructions

—By bedding DBS/R instructions in a carrier language

The DBS/R language will describe complete data processing routines without any other aids, although it is not intended to be a substitute for a higher programming language.

User programs can consist also of DBS/R instructions and of instructions of a general programming language. The latter is then the carrier language. DBS/R instructions can be bedded into the carrier languages ASSEMBLER, PL/1 and COBOL.

User programs, conceived as assignments of the DBS/R remote processing system, are generated by translating and by storage in a loading library. Programs and modules which call DBS/R user programs, or which are called by these, employ a DBS/R specific control block.

Command language: The command language controls the work of the remote processing system of DBS/R. The remote processing system works primarily in subscriber operation. The subscribers employ commands, transactions and information for traffic with:

—The remote processing system.

—The previously produced user programs.

—Amongst each other.

The command language is adaptable, and its code and operands can be changed according to the wishes of the user.

Course of development and current application situation

The correctness, on principle, of the DBS/R concept was established during two large scale tests conducted in 1977 These tests were based on concrete cases of application. After the successful second test, DBS/R was incorporated in the program library of the Unified Computer System, thus making it freely available to U C S member countries

DBS/R was developed and supplied to the users in a series of steps The DBS/R version now available places the user in the position to set up a data bank system and to operate it under the inclusion of remote data processing Data bank systems of differing size and sophistication are being currently operated The latitude of their application is very wide indeed. DBS/R is being used by the chemical and metal-working industry, and it is forming the heart of application projects in material economy, accountancy and production control. Other well advanced cases of application are information systems of governmental institutions which also employ the remote processing system of DBS/R. One of these information systems has, as data base, the most comprehensive bank formed hitherto with DBS/R. It is composed for 50 base files and connecting files.

A comparison with other data bank operation systems shows that the performance specifications of DBS/R compare very favourably with international standards, and the concept of storage and the treatment of input data of the system are worth special mention. Furthermore, the possibilities of user programming, and this includes independent programming with the help of the DBS/R language and the user of different carrier languages, are unchallenged by any of the internationally common data bank operation systems.

On Display at the India International Trade Fair

ROBOTRON 1711

Small Invoicing Machine

With the DARO 1711, VEB Robotron-Buromaschinenwerk Sommerda is introducing a new development to their previously successful invoicing machine. The small invoicing machine DARO 1711 is a profitable investment for small firms, such as craftsmen, retailers, agents and others, who predominantly use an office typewriter.

Its automatic accounting and output process enables rational and simple processing of the invoices resulting from the daily transactions.

The DARO 1711 small invoicing machine combines an electric typewriter for correspondence with an electronic calculating, storing and program unit.

The operation and design of the typewriter corresponds to the requirements of an office typewriter regarding the range of characters and the functions and layout of the keyboard.

For its application as an invoice machine, the numeric information is keyed in through a separate numeric keyboard, combined with a function keyboard located next to it.

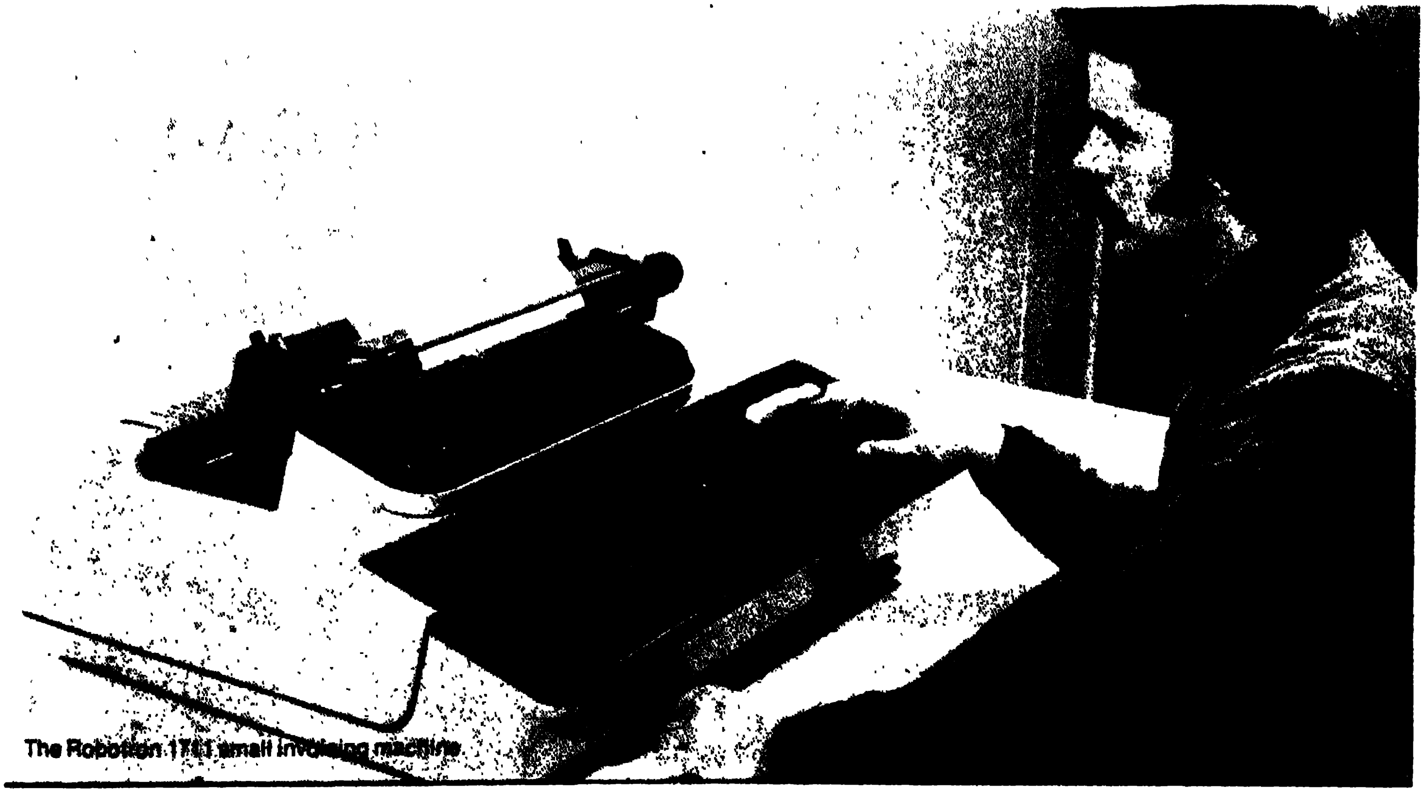
Release of the input operation is performed by a start key. Error correction of input before printing is performed by means of a CLEAR key.

Individual program parts can be selected manually by a selector key. The computer unit performs the 4 basic accounting procedures. The data storage unit (RAM) is designed to receive 16 words / 64 bits. A maximum capacity of 512 bytes is available for the storage of the macroprogram. The small invoicing machine is a compact machine, i.e. the individual components are accommodated in a self-contained casing. The time required to set it up for use can be reduced to a minimum, as fixed programs are available for standard accounting, or rather can be quickly formulated and delivered with the DARO 1711 small invoicing machine.

A simple front feed device enables the DARO 1711 to be used also for easy accounting.

TECHNICAL DATA

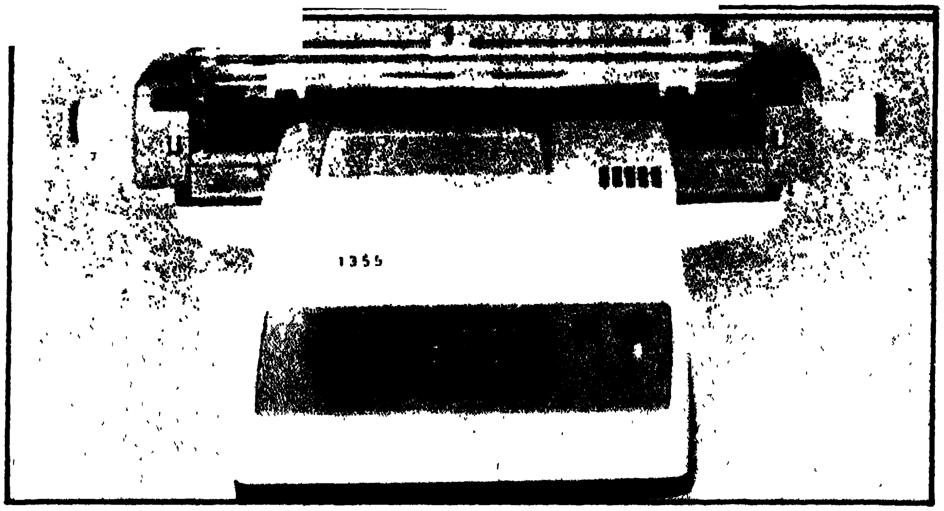
Central Processing Unit	
- Data Store	16 data stores (1 word 16 num places 64 bits) of which 4 words are internal registers.
- Microprogram	2 byte
—Macroprogram Store	0 50 K byte in easily exchangeable cassette
Output	via electric type bar keyboard mechanism Spacing 2 6 mm Carriage width 32 or 46 cm (optional) Speed 13 c p.s
Stationery	single sheet processing fast paper input manual front feed
Keyboard	specific to the country **typewriter Keyboard** function keyboard indicator lamps
Power Supply	110 V, 220 V, 240 V · 10% --15%/50Hz
Measurements	Length 720 mm Width: 670 mm Height: 270 mm
Weight:	50 kg



The Robotron 1711 small invoicing machine.

ROBOTRON 1355

Accounting Machine



The accounting machine Robotron 1355, a means of rationalisation conceived for small and medium size enterprises, is a numerical printing table unit which is freely programmable. It combines the use value characteristics of conventional models such as

- minimum space requirement
- low weight
- ease of operation and
- quick program change

with the following advantages compared to the earlier models 1330/1350

—Ease of keyboard operation and the low noise level provided greatly contribute towards a high standard of operational comfort

—A data stores are available for extensive programs and can be called both automatically and manually

—Input of programs by the keyboard is very fast and can be verified at any time

—Addition, subtraction, multiplication and division are standard functions

—Reliable posting is ensured by programmable checks, any operating errors or faults being signalised by a light indicator

—The machine being designed as a desk calculator is suitable for supplementary routine work, since all four basic arithmetic operations can be carried out via the keyboard.

—Availability of double and single zero keys

The accounting machine Robotron 1355 affords day-to-day in-house settlements and is capable of matching the most differentiated needs of the users. In this way, it lends itself for economical use in all fields of accounting and data collecting in

industry, trade,
financial and credit institutions,
agriculture, forestry and building industry,
post offices, insurance companies, commercial administrations, scientific institutes etc

Particularly the functions of multiplication and division open up new fields of application affording directly measureable profits· separate evaluation of vouchers and transfer errors involved are eliminated; savings in time and cost.

The example given below shows one of the many possible program variants:

Material Accounting with amount falling short of the minimum stock level

The program comprises both ascertainment of actual stock per article card and information on procurement of material whenever stock has dropped below the minimum quantity

Strip				**Journal balances carried forward with automatic correction of carryforward errors**	**Article Card**			**Price: M3 —** **Min. stock level 150 pcs.**	**Article No: 2143053**
Article No	**Quantity ordered**	**Amount falling short of min. stock level**		**. Minimum stock .**	**Voucher No.**	**Price**	**Quantity Incoming/ outgoing**	**Value incoming/ outgoing**	**New Stock quantity**
		settled	**still to be settled**						
				150		**3,00**	**500**	**1500,00**	**500**
2143053			**10-**	**150**		**3,00**	**360-**	**1080,00**	**140**
2143053	130	20		**150**		**3,00**	**100-**	**300,00**	**40**
						factor	**factor**	**product**	

The value is automatically calculated in the accounting process and stored separately for incoming and outgoing

SPECIAL SUPPLEMENT -

Also Available in India Against Rupee Payment

ROBOTRON 170. Automatic Accounting Machines

Automatic accounting machines Robotron 170 are equipped with all features expected on modern book-keeping machines and in every office where they are installed efficiency and speed result.

Listed below are some of the special features common to the 170/2, 170/3 and 170/5 models.

1. Capacity for entry and totalling is 12 digits.
2. Balance selection is available in two registers on all models.
3. High speed electric typewriter.
4. Either 18 separate 4 symbol abbreviations or 9 separate 8 symbol abbreviations.
5. General reverse key for immediate error correction. The entire register action is reversed by this key wherever operated.
6. Automatic wheel date.
7. Easily interchangeable control panels.

More than 2000 machines already in use in India in banking and financing applications.

BLUE STAR

For further information, please, contact: Blue Star Limited, Business Machines Department at 414/4 Vir Savarkar Marg, Prabhadevi, Bombay 400025 or at Bhandari House, 91 Nehru Place, New Delhi 110019.

ETTDC

Imported by Electronics Trade and Technology Development Corporation Limited, 15/48 Malcha Marg, New Delhi 110021.

robotron

ROBOTRON 425

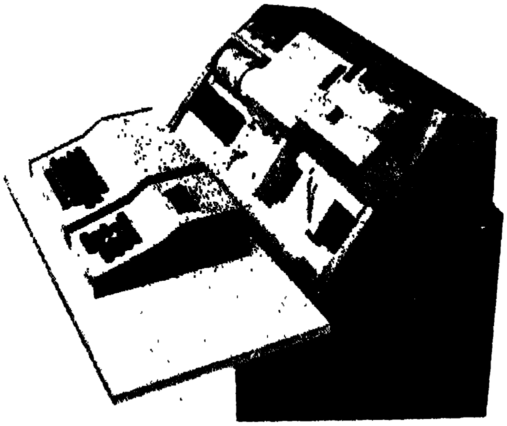
Card Verifier

The Robotron 425 Card Verifier is used to check the numerical or alphanumerical data stored in 80-column punched cards and makes them available for further processing. The Robotron 425 is used together with the Robotron 415 Card Punch for better unification of organisation The punched cards are supplied with shortest possible delay and deposited immediately after the check. Constant data are automatically checked while variable terms are put in by hand. An error detected by the Robotron 425 is instantly indicated by a signal lamp. Cards with faulty punching get a notch in the upper edge for the corresponding column; correctly punched cards get a check notch.

Specifications

Automatic checking:	20 columns/sec.
Duplicating checking:	20 columns/sec.
Jump:	80 columns/sec
Card supply and stacking:	1 sec.

For further information please contact: Computer Maintenance Corporation, 2nd Floor, World Trade Centre, Cuffe Parade, Bombay.



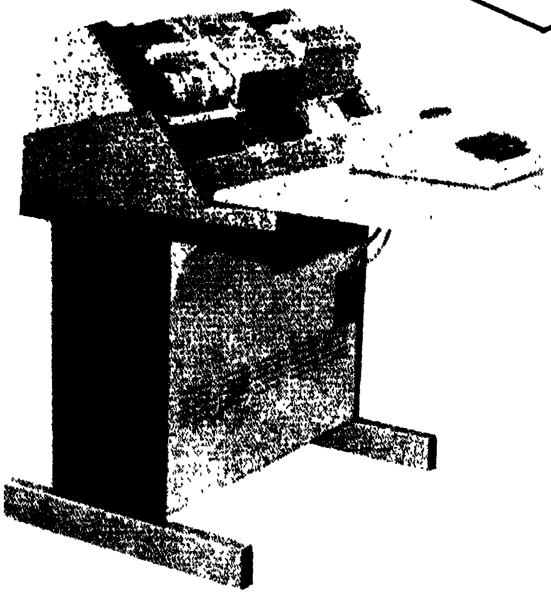
ROBOTRON 415

Card Punch

The Robotron 415 Card Punch is used for the acquisition of numerical and alphanumerical data in 80-column punched cards. It acquires operating and program data in off-line regime in electronic data processing; in the medium size data technology it is used as a coupler to automatic booking and accounting machines for immediate acquisition of primary data during writing of invoices, booking journals, and analogous documents. According to application, the Robotron 415 can be equipped with keyboards which differ in the character fund and encoding mode.

Specifications

Duplication:	20 columns/sec.
Jump:	80 columns/sec.
Feed hopper and card stacker capacity.	500 punched cards each
Card feeding and stacking:	1 sec.



ROBOTRON 415 s

Typing Punch

The Robotron 415 S Typing Punch is characterised by its versatile use as a data acquisition device in punched card-oriented organisation modes of machine-operated and electronic data processing. It is used with maximum profit for operations in which acquisition has immediately to be followed by a visual data check, such as in the production of punched program cards for EDP systems, decentral data checks, or in case that the punched card is used as basic data carrier or file card.

Use of the Robotron 415 S Typing Punch combines the advantages of computer data processing with those of interpretability and sortability of primary documents.

Specifications

Automatic duplication:	20 columns/sec.
Jump:	80 columns/sec.
Feed hopper and card stacker capacity:	500 punched cards each
Card supply and stacking:	1 sec.

The hot little idea that's spreading like wildfire.

Last year, Fairchild silently slipped over the silicon border into the 16-bit microcomputer systems business.

Our first product was the 9440 MICROFLAME™ microprocessor. We introduced it as "the microprocessor that thinks it's a minicomputer." But it looked like a component. So most people assumed it was just a component.

It wasn t.

It was the heart of a microcomputer system.

The 9440 was the beginning of a systems family. Designed to let you buy a microcomputer one function at a time.

The idea caught on. Like wildfire.

Fairchild now has a separate organization totally dedicated to high-performance microcomputer technology.

The FIRE Microcomputer Group.

In the past few months they've built a healthy little 16-bit microcomputer systems business without much fanfare.

The time has come for fanfare.

Please turn the page.

FAIRCHILD

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Sales Representative in India

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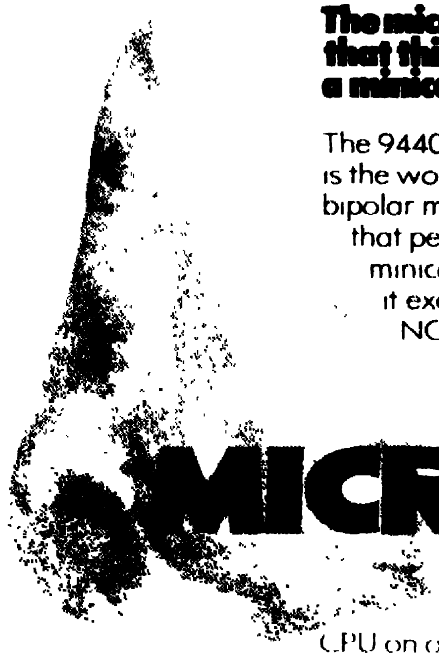
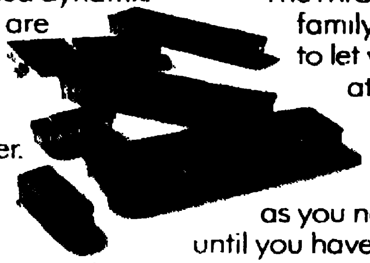


The microprocessor that thinks it's a minicomputer.

MICROFLAME

The 9440 MICROFLAME is the world's first 16-bit bipolar microprocessor that performs like a minicomputer. In fact, it executes the NOVA* instruction set. It's a complete minicomputer CPU on one chip, packaged in a 40-pin DIP. It is supported by other family members.

The 9441 memory and DMA controller And the 9442 I/O bus controller. These three LSI chips, plus our performance-matched dynamic bipolar RAM are all that is needed to build a full microcomputer.



Major applications for the 9440 MICROFLAME include OEM data processing systems used in a variety of computing control and instrumentation environments. Telecommunications PBX and PABX switching installations. And distributed intelligence, distributed multiprocessing and front-end (terminal) processing.

The MICROFLAME family is designed to let you design at your own speed, adding functions as you need them, until you have just the microprocessor system you need.

FIRE MICROCOMPUTER GROUP
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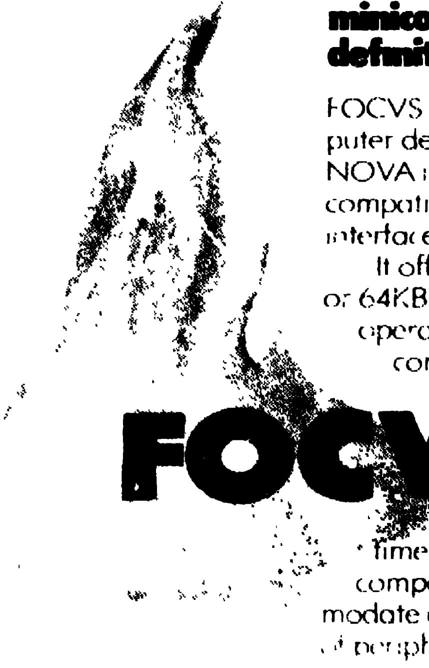
*NOVA is a trademark of Data General Corporation



The OEM minicomputer with definite ideas.

FOCVS XVI

FOCVS XVI is a minicomputer designed to use the NOVA instruction set and compatible I/O peripheral interface boards.

It offers either 32KB or 64KB of dynamic RAM operating at minicomputer execution times. It's I/O bus compatible to accommodate a wide range of peripherals. And it's supported by FIRE System software, allowing it to run millions of lines of applications software you've already developed.

The FOCVS XVI 9-slot chassis gives you up to eight extra slots so you can plug in other 15" x 15" boards. And it has front-panel controls for latch and display of data addresses, and examining memory or register contents.

Depending upon the minicomputer performance required the FOCVS XVI may be equipped with either the GLOW-16 or BLAZE-16 15" x 15" boards. The boards may also be purchased for use without the FOCVS XVI enclosure for integration into your chassis.

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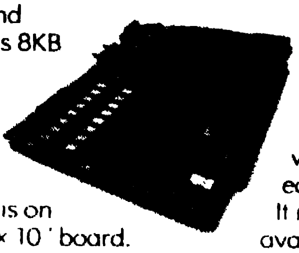
SPARK-16

OEM microcomputer with growth in mind.

SPARK-16 is a single-board microcomputer supported by our FIRE software. It uses the 9440 MICROFLAME to give it minicomputer performance and is supported by companion boards to enhance its memory and input/output capabilities.

What you do with it depends on what you want it to do. It comes with 4KB of autoload PROM with FIREBUG, Interface Logic for current loop or RS 232C, a 100-pin connector, control switches and display. Plus 8KB of static or dynamic RAM. Or 16KB of dynamic RAM. All this on a single 8" x 10" board.



If you need even more memory, just add our SPARK-MEM board for up to 64KB of dynamic RAM, with parity.

For I/O intensive applications, you can add the SPARK I/O board — a general-purpose input/output control that helps make SPARK 16 do what you want it to do.

The THERMOSTAT, a handheld console, is also available to make your job easier.

SPARK 16 is easy to work with and easy to find. It is already available from over 60 distributor locations.

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FIRE SOFTWARE

The software you've already paid for.

If you've spent time and money developing your own applications software that uses the NOVA instruction set, we have a pleasant surprise for you.

Using our Fairchild Integrated Realtime Executive (FIRE) System software, you can run those expensive lines of applications programs on our computers. Our SPARK-16 Microcomputer, Or our FOCUS XVI Minicomputer; our BLAZE-16, our GLOW-16 or our MICROFLAME Development System.

If you're about to write new applications software, consider this: the FIRE family of microcomputers is offered with extensive software support. It uses software familiar to most minicomputer programmers. And the NOVA instruction set has been proven for years.

Operating systems, powerful text editors, diagnostics, assemblers and high-level languages are all at your disposal from Fairchild

FIRE MICROCOMPUTER GROUP
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The development system that speaks a familar language.

From the beginning, our entire MICROFLAME™ microcomputer family has been designed to be compatible with hardware and software you already have.

Our new development system is no exception.

It lets you develop applications software for our 16-bit microprocessors using the familiar NOVA* instruction set. You'll also be able to employ "off-the-shelf," industry-standard peripherals. Including high-speed

MICROFLAME™ DEVELOPMENT SYSTEM

readers, printers, PROM/FPLA programmers, modems, magnetic tape (800/1600 BPI, 9-track), cartridge disks (10MB) and storage modules (80 or 300MB).

You can save considerable time and money because you won't have to rewrite all of your programs or learn a new language. Which translates into shorter lead time to get your product on the market.

The benefits grow on you.

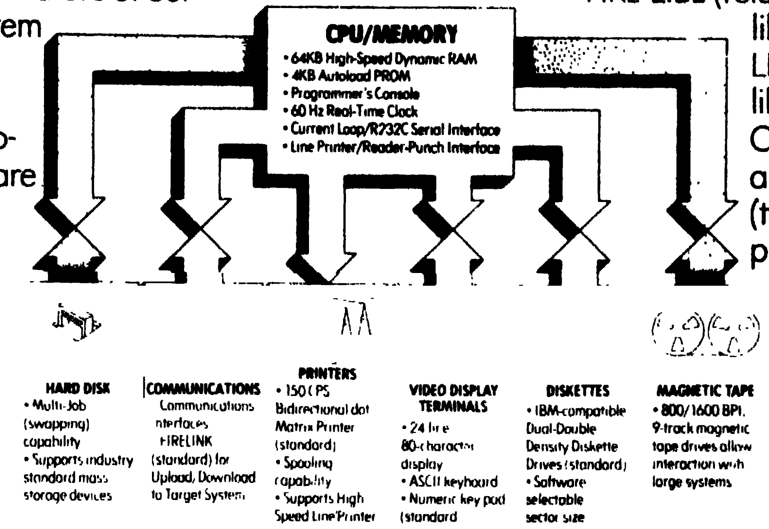
Fairchild's MICROFLAME Development System is an enhanceable system designed to develop prototype hardware and software for a broad range of microprocessor applications. From PROM resident code for MICROFLAME-based controllers to realtime multitasking software for distributed processing or control applications using the FOCVS XVI computer.

For the record, our development system combines the FOCVS XVI, a powerful computer offering 64KB of RAM, with a dual-double-density IBM-compatible floppy-disk subsystem (1 megabyte capacity expandable to 4 megabytes). A free-standing video display terminal and a 150-CPS bidirectional dot matrix printer complete the basic system.

A powerful link.

An important feature of our development system is the FIRELINK.™ It links the target-prototyping microcomputer hardware to the MICROFLAME Development System via an RS232C port. FIRELINK is used to upload or download assembled programs into the target system and to debug and monitor, remotely, the execution of object code in the target hardware.

FIRELINK has the additional capability of communicating with remote target systems or other MICROFLAME Development Systems via a modem/acoustic coupler over telephone lines if necessary.


CPU/MEMORY
• 64KB High-Speed Dynamic RAM
• 4KB Autoload PROM
• Programmer's Console
• 60 Hz Real-Time Clock
• Current Loop/R232C Serial Interface
• Line Printer/Reader-Punch Interface
HARD DISK
• Multi-Job (swapping) capability
• Supports industry standard mass storage devices
COMMUNICATIONS
Communications interfaces FIRELINK (standard) for Upload, Download to Target System
PRINTERS
• 150 CPS Bidirectional dot Matrix Printer (standard)
• Spooling capability
• Supports High Speed Line Printer
VIDEO DISPLAY TERMINALS
• 24 line 80-character display
• ASCII keyboard
• Numeric key pad (standard
DISKETTES
• IBM-compatible Dual-Double Density Diskette Drives (standard)
• Software selectable sector size
MAGNETIC TAPE
• 800/1600 BPI, 9-track magnetic tape drives allow interaction with large systems

Software with FIRE power.

The integrated hardware is fully supported by the Fairchild Integrated Realtime Executive (FIRE) System software.

The Interactive Multitasking Disk Operating System (FIRE-IMDOS) supports extended file management, timesharing and device-independent I/O on the development system.

With user-supplied high-performance peripherals, FIRE-IMDOS supports timesharing for a number of users, limited only by performance of the swapping device. Additional features include password protection and version number control for automatic tracking and backup during the debug phase of development. Spooling capabilities allow printing to proceed concurrently with other interactive activity, thereby increasing the throughput of the system.

The system includes, as standard, system processors such as FIRE-EDIT (text editor), FIRE-MACRO (macroassembler), FIRE-SYMBUG (symbolic debugger), FIRE-LIBE (relocatable utility library), FIRE-LIBEDIT (relocatable library editor) FIRE-OEDIT (octal editor) and FIRE-TYPESET (typesetting program).

The software for PROM formatting and burning is standard on our system using either an attached user-supplied PROM programmer or a detached paper tape.

Optional high-level languages under the development system software include BASIC, FORTRAN and PASCAL.

The system is delivered complete with documentation and an automatic installation and system-test diskette to assist user setup and checkout of the system.

*NOVA is a trademark of Data General Corporation

FIRE MICROCOMPUTER GROUP

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For more information, please contact
Sales Representative in India :

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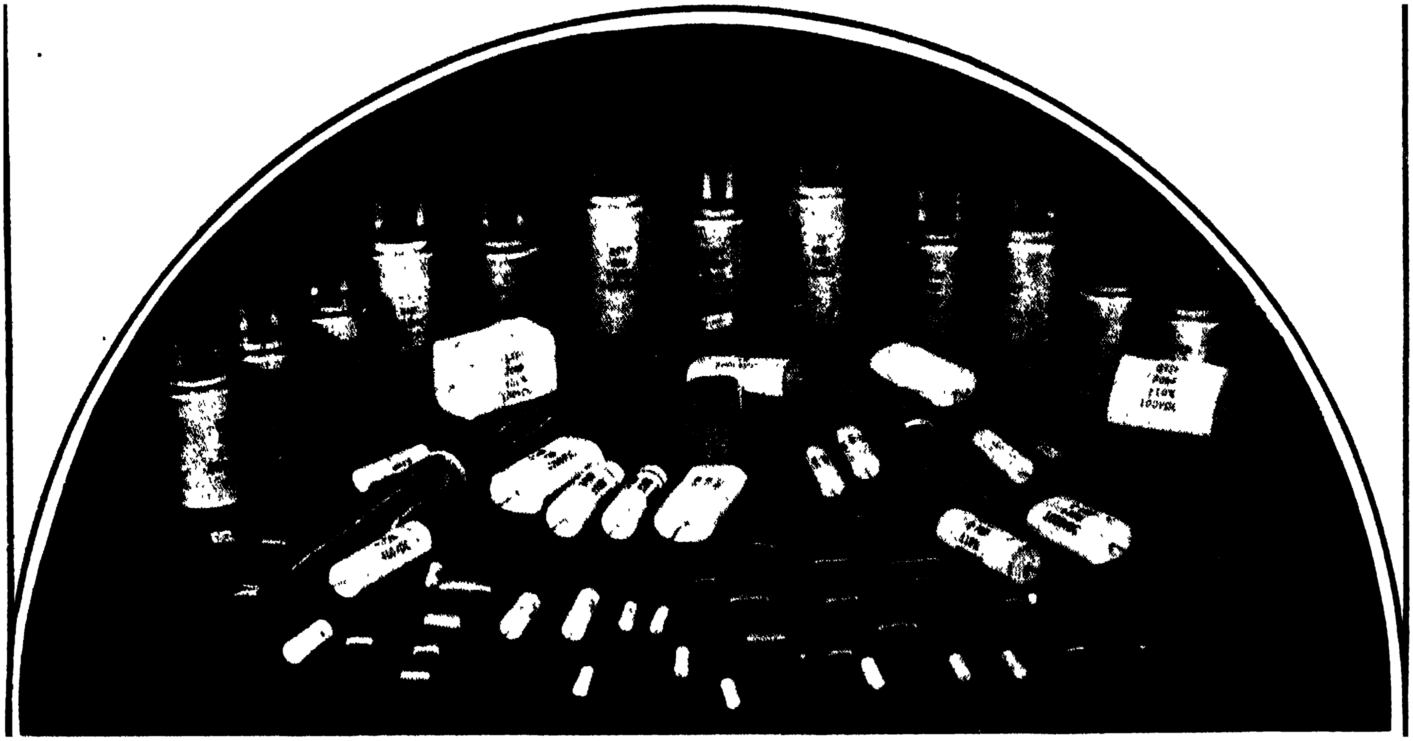

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LOGIC ANALYSER
A TOOL FOR DIGITAL TESTING

G.V. Anjaneyulu and B.V. Bajaj

Introduced in 1973, logic analysers are nowadays used widely for digital system testing. A general description of various features of a logic analyser is given here. The article is expected to help logic designers and troubleshooters in understanding the features of a logic analyser and to select an appropriate analyser out of the many available in the market.

Finding out an intermittent fault in an electrical circuit can be quite frustrating and time consuming. The more complex the circuit, the bigger is this problem. Today, there are a number of instruments for isolating faults in complex digital equipment, and the logic analyser is about the most sophisticated among these. It is used by both design engineers and servicing personnel.

Digital circuits confront designers and troubleshooters with measurement problems which differ in many ways from those in analogue circuits. As a result, instruments developed for analogue measurements are often less than optimum for the new digital measurements, and the logic analyser is needed specifically to solve digital problems

Logic analysers are of several types and can be distinguished by the kind of display they are capable of producing. Some have numerous lights that indicate a sequance or a combination of 'ones' and 'zeroes.' Some can display 'ones' and 'zeroes' as numbers on a CRT screen or a video monitor as though they were printed on a page. Others can display 'ones' and 'zeroes' in the form of 'highs and lows' in a multi-trace timing diagram on a CRT screen.

Instruments of this kind can capture and display data as well as relate it to units of time. The on-going diffusion of digital techniques into all branches of electronic design has radically changed the nature of many—if not most—design, production, test, and field maintenance tasks. Electronic engineers, who have learnt the uses of underlying mathematics and analytical instrumentation for designing in the frequency and time domains, must now become familiar with the data domain too.

The most important characteristic of logic analysers is that they can capture digital data prior to the first indication of a circuit fault. They can then display what was captured for as long as required. That way, the events which lead up to the moment of a failure can be analysed. An ordinary storage oscilloscope cannot do that. For unpredicted one-shot events like an intermittent failure, oscilloscopes can only show what happens after having received a trigger signal.

Logic analysers can also be operated to capture data after receiving a trigger signal, and that is important at times.

The method of capturing digital data leading to and beyond a fault is to continually store new data while erasing old data. It is similar to a continuous loop tape recording of a conversation. As soon as the loop of the tape has been fully recorded, the older conversation is erased as the new words are recorded. If one has a way of recognising a lie in the conversation the instant it is fully told, one can stop recording at that instant and repeatedly play back the whole thing.

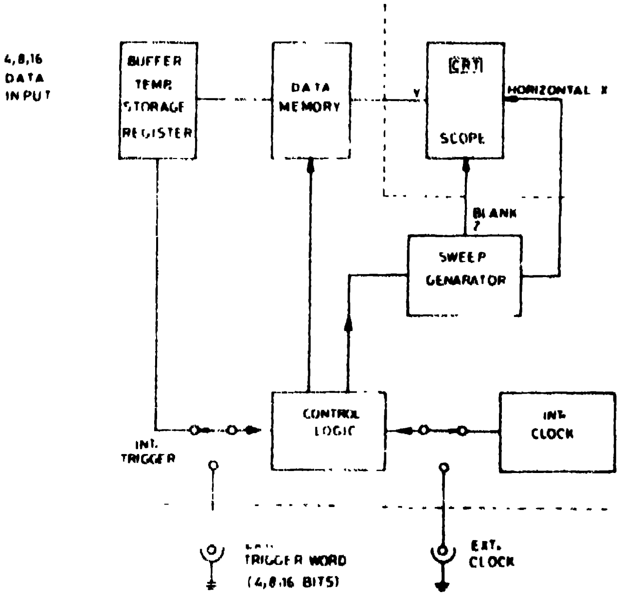

Fig 1· Simplified block diagram of logic analyser

To record a faulty digital signal in a similar way, one can clock it into a shift register, allowing old data to spill out as soon as the register is filled. Then, at any time, one can stop the input and recirculate the contents of the register and

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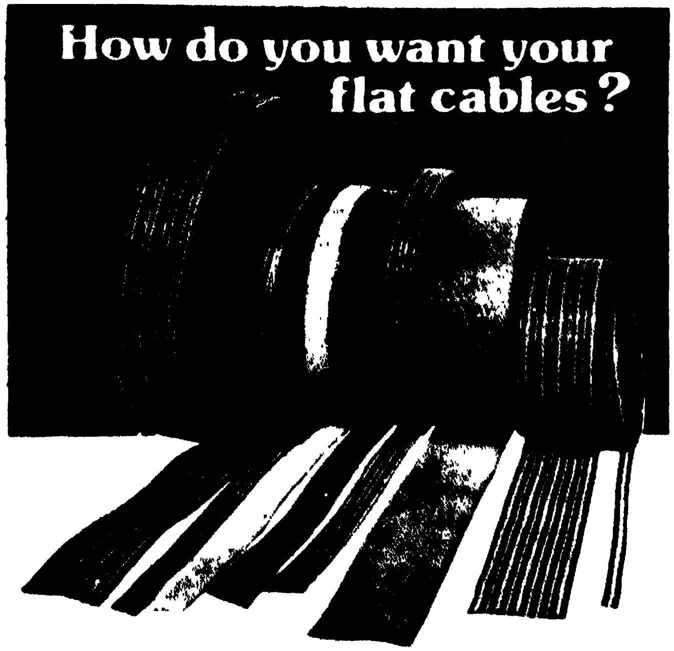
Both Mr Anjaneyulu and Mr Bajaj belong to the measuring instruments division of Electronics Corporation of India Limited, Hyderabad



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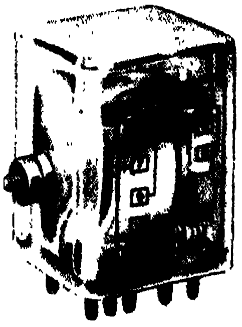

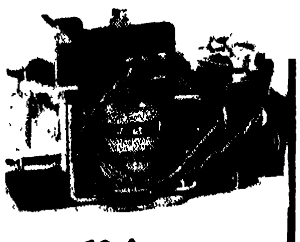

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repeatedly display the contents as a sequence of 'ones' and 'zeroes'. The pattern will display the history of data flow just prior to shutting down the recording process..

By using any signal that may be an early symptom of a fault as a trigger, the recording can be stopped and events leading to the fault can be displayed. Recording need not be stopped instantly. It may be allowed to continue for a selected number of clock cycles if the later events are significant.

The next important characteristic of a logic analyser is that it has many input channels. Four, eight and sixteen channels are common for analysers designed to display recorded binary signals as a timing diagram on a CRT screen. Data on each of the input channels is clocked and recorded simultaneously and then stored in independent memories. That way, any input signal can be compared with any other input signal to show the logic states that existed at any particular moment. This is what a timing diagram does.

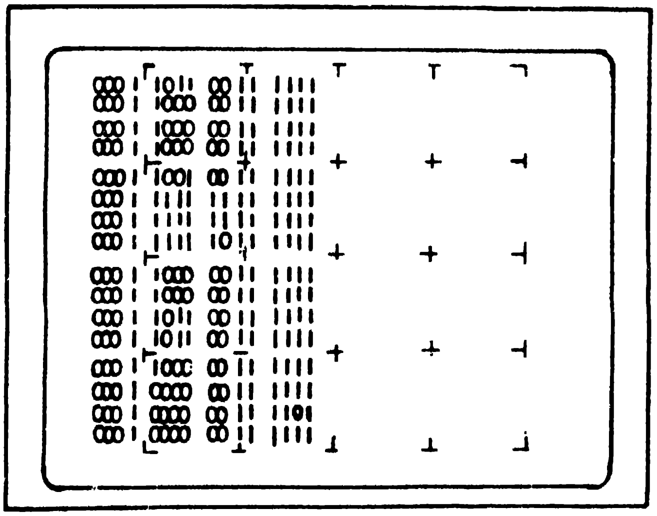


Fig. 2 Logic state display

Multichannel recording is of critical importance when data is transmitted over more than one line, e.g. 4 lines for BCD data, or 7 lines plus 1 parity for ASC II character etc. In all such cases it is the combination of 'highs' and 'lows' that may exist at any moment on a set of such lines, which indicates a faulty/ normal condition.

But multichannel recording need not be restricted to only binary signals on lines that transmit data words. An engineer debugging a latest design may want to compare any binary signal with a bunch of others that have a predetermined dependence.

Logic analysers continuously 'sample' the voltage state of any signal where a data input probe is placed by comparing it against a preset level that is between a 'high' and a 'low'. One probe is used for each channel. Comparisons are simultaneous at all inputs, so that the voltage level at different inputs during any sample can be stored and displayed.

The comparison can be made with reference to either a internal or an external clock signal. An external cloc signal is normally the same as the one employed in th equipment under test. That way, clocking is synchronou with whatever is going on in the equipment under test, eve if the clock signal is periodic.

The internal clock frequency is usually selectable. Normally a clock period that is at least three times shorter tha the clock period of the equipment under test is selected This permits at least two comparisons to be made of eac new 'high' and 'low' level, following any transition in th signal being sampled. By using a considerably higher cloc frequency than the system clock, gliches and noise spike may be recorded and later displayed. With a 100MH clock, gliches as narrow as 15n sec., can be recorded reliably.

The sampled data is compared each time to a prese threshold level to see whether the voltage is 'high' or 'low' If a signal voltage is higher than the threshold voltage, 'high' is clocked into a storage register. In the opposite cas a 'low' is stored. This results in a series of 'highs' and 'low that shift through each register and resemble the pattern o the original binary signal sampled.

Some logic analysers using a CRT for readout have th CRT built-in. Others have to be hooked up to a monito CRT or oscilloscope. The main reason for not including CRT with every logic analyser is that they would becom bigger and more expensive. Besides, logic analysers ar sometimes operated for hours, merely waiting for a fault condition to manifest itself. A monitor or oscilloscope i not needed during such periods and can be attached afte the error information has been captured. In fact, the display is always a replica of what has been previously store in memory.

Working

A simplified block diagram of a logic analyser is shown i Fig. 1. The data inputs can be either from 4, 8 or 1 channels, depending on the requirement of the circu under test. The probes are selected such that the inpu impedance is high and the inputs are buffered in a storag register. The sampling frequency can be either extern clock of the system under test or an internal clock. Shortl after receiving a trigger signal, either external or from pre-selectable trigger word switch, the analyser stops recording.

Control logic which generates the address to the memor to select channel data to be fed to vertical Y-input, usin the generator, also generates the horizontal X-input an blanking signal for oscilloscope to display state diagram. I map mode display, the least significant half of the wo stored in memory is converted into an analogue signal a fed to X-input, while the most significant half of the word stored in memory is converted into an analogue signal and fed to Y - input to display in a dot matrix

Control features

Most logic analysers have the following control features:

1. Triggering word: Triggering begins the analyser's data input and display process. The trigger point is the reference point to which all following events relate. The analyser's control provides multiple events occuring simultaneously. This capability is necessary in digital applications because digital systems commonly function in response to parallel data patterns occuring simultaneously on several circuit nodes.

Normally a choice of three sources is provided by a front panel switch: (i) channel 'O' of the probe input, (ii) external via BNC input, (iii) or from the built-in, 16-bit word recogniser. A fourth choice is manual triggering by front panel push-button.

The 16-bit data inputs serve as inputs for the word recogniser. Front panel switches allow selection of any pattern of up to 16 parallel bits as the trigger word. In some analysers two additional inputs called qualifiers allow further selection of the triggering point, giving, in essence, an 18-bit word recogniser.

When all the conditions required for word recognition are met, the data acquisition circuits are enabled and a signal is supplied to a front panel connector for triggering an oscilloscope or the in-built CRT display.

Data inputs: 4, 8 or 16 channels or parallel data can be acquired simultaneously by normal logic analysers. Minimum loading on the circuit under test is achieved by active probe circuitry. A choice of threshold levels for the probe inputs — a preset voltage level for TTL applications or selection over a range of ±12 volts (to be used with other IC technologies like MOS, bipolar and ECl) by a front panel variable control — is normally available. Data can be clocked synchronously or asynchronously.

Digital delay: Normally, once the analyser has triggered, the data is displayed with reference to the trigger word. When the data one wants to see does not immediately follow the desired trigger word, delay can be used to position the 16-word 'window' an exact number of clock pulses (many analysers provide up to 99,999 clock periods) from the trigger word.

Digital delay is useful for moving the display window past loops and measuring lengths of sub-routines while maintaining a desired pattern trigger point. A stable delay is always maintained because the delay is determined by the number of clock pulses rather than an analogue time delay. A 'delay on-off' switch allows quick reference back to the trigger word if it has been moved off-screen by the delay.

Start display/ end display triggering: In the start display mode, the analyser triggers on the set trigger word and displays it along with the 15 following words as they are clocked.

In the end display mode, the analyser captures events leading up to and including the set trigger word providing negative time display. This is extremely useful in troubleshooting. The number of data words displayed are the same in both the start display and the end display trigger modes.

Save memory: The store 'A' into 'B' mode (A→B) duplicates the data in the A memory into the B memory which then acts as a save register. By storing this reference data, one can make comparisons between the A and B tables for quick troubleshooting.

An exclusive OR (A⊕B) capability displays the A memory data and reduces the B memory to a display of logic differences on a bit by bit basis between the A and B memories. This permits fast, at a glance, comparison of complex sequences. A 'halt when A does not equal B' mode (A ≠ B) automatically halts and stores the data in the A table when the data in the A memory does not equal the data in the B memory.

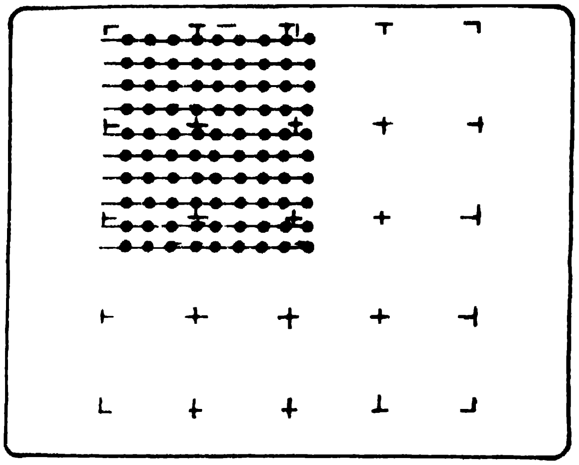


Fig. 3: Logic map display

Sampling rate: A clock qualifier is used when the analyser is sampling in the synchronous mode using the clock of the system under test. During normal synchronous operation, new data is sampled into the memory once every clock cycle. When the clock qualifier is activated, sampling only occurs when the clock cycle has been qualified by an external signal. Data sampling can be asynchronous (internal clock). In asynchronous mode, sampling rate is selected by the internal clock.

Display: After data storage is completed, control of data memory is transferred to the display control. The state display, shown in Fig. 2, arranges the data into an easily readable format. This formating includes dividing the rows of bits into 3 or 4 bit bytes, depending on the byte control, for easy grouping into octal, hexadecimal or BCD characters.

The map mode display shown in Fig. 3 is used to display unique data words in memory. The display is an array of 2^n (n = 4, 8 or 16 bit data word length) dots where each dot represents one possible combination of the 16 bit lines so that every input word is represented by an illuminated dot. The 'n' bit word is divided in half with the half of the least significant bit determining the horizontal location of the word and the most significant half determining the vertical location.

The map display presents three types of information. Each dot represents a specific address or the state machine goes to the relative frequency of occurrence of that state and the line between dots is a vector where the brighter end of the vector is the 'goes to' address. A map cursor, which is positioned with the trigger word switches, shows the trigger word or address of any desired dot in the map display.

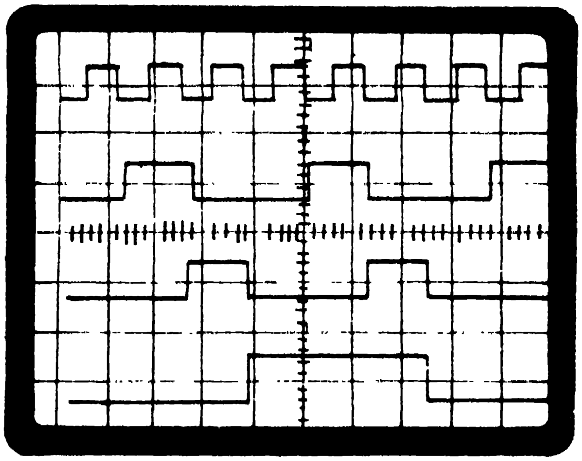


Fig. 4: Logic time display

In the time mode display shown in Fig. 4 all the 'n' channels data (n = 4, 8 or 16 channel) is arranged in groups of four with a fixed amount of separation between each channel. The traces correspond to channel O through n, reading from top.

A rotary control is used to select the time for which stored data will be held for display before a new record cycle starts. It is called display time control and varies from less than one second to at least five seconds in many analysers.

Column blanking: This control allows unused channels to be blanked from the screen, facilitating the use of the logic analyser.

Indicators: Various indicators are provided on the front panel of the analyser normally. These indicate quickly, pin-pointing the problem, to show one what is preventing display, such as no clock, no qualifier, no trigger etc. If these are not satisfied, then the NO indicator will light until it is satisfied.

Many other features are also available normally in analysers. A clock threshold can be selected for fixed TTL levels. It can also be selected for variable levels and adjusted to the desired threshold level (like MOS, bipolar, ECL, IC logic). A logic positive or negative switch permits the displayed pattern to match either the positive or negative true logic system. This changes only the display to match the system under test and not the data logic.

The analyser records and displays multichannel binary data on the CRT simultaneously with one beam only. It displays all the data sequentially, one channel at a time, one trace at a time, at a rate high enough to facilitate steady and non-flickering traces.

After each sweep occurs, a stair step signal moves the beam down one step during the retrace interval. Then, as the beam is swept across again, data from the next storage register moves the beam up or down a small fixed amount to correspond with the 'highs' and 'lows' of the stored data for that channel. The whole sequence repeats after all selected storage registers have been scanned.

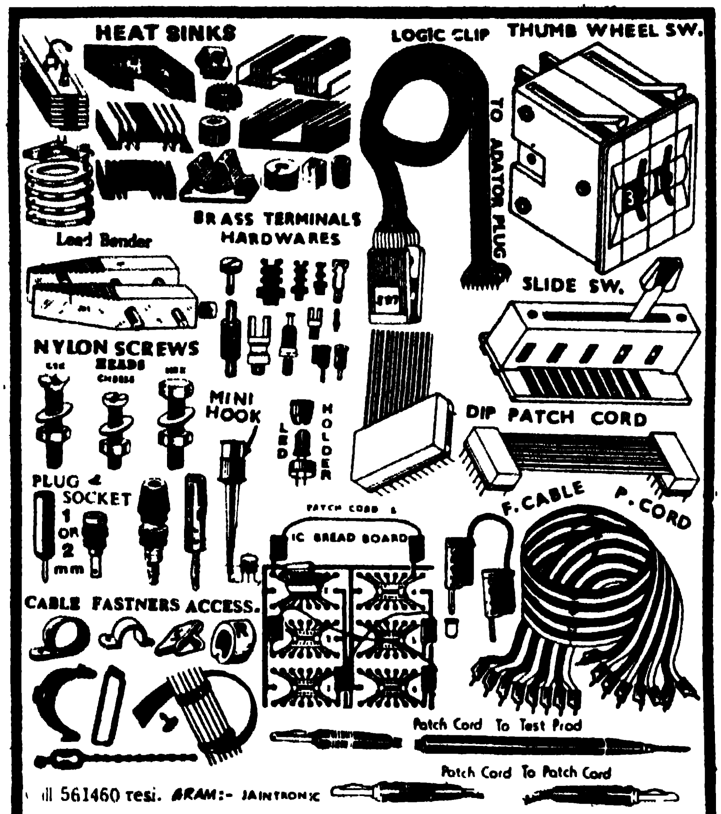
There has been much discussion as to whether the logic state or the logic timing display is the most useful in performing logic analysis. Each has advantages for specific applications. Some logic analysers provide both types of display.

Applications

Logic analysers have applications in a wide variety of microprocessors, in many microprocessor peripheral activities involving complex state sequences and in microcomputers with their use of both macro- and microprocessor languages. Other areas include computers, magnetic tapes and disc drives, card readers, teleprinters, paper tape readers, ROM controlled instruments, digital data transmission terminals and many others.

The analyser's digital delay facility makes it easy to see and analyse the long, non-repetitive signal sequences that occur in serial data transmission, such as between remote terminals and a computer. Moreover it captures and stores the short, randomly occuring noise pulses that often cripple an entire system while escaping detection by conventional means. The map mode of the logic analyser displays unique data words in memory.

Besides the applications of the logic analyser in different system measurements, it is probably used most often as a general-purpose bench instrument in common digital troubleshooting situations. Additional capabilities built into the logic analyser greatly extend its flexibility in certain applications. The formatable memory offers unparalleled flexibility and the high speed data acquisition and minimum loading afforded by active probes makes it suitable for working with higher speed logic families. □



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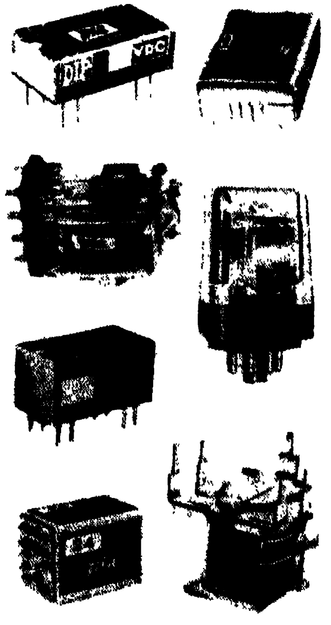

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UNDERSTANDING THE DIGITAL PANEL METER

B.K.N. Dutt

As technology advances an indication of physical quantities in more precise terms has become an absolute necessity. The digital panel meter (DPM) is an offshoot of the ordinary analogue panel meter—the moving coil meter. Defined in brief terms, a DPM is basically an analogue to digital converter with a visual readout. Just as the pointer of the moving coil meter moves as the voltage applied to it changes, the DPM periodically samples the input voltage at a fixed rate, converts the voltage to digital outputs and displays the corresponding reading on a visual readout.

The case for a DPM

The decision whether to use a DPM depends on three main considerations: (i) accuracy of performance; (ii) cost; and (iii) aesthetics.

The DPM offers tremendously good performance on the above scores. Digital display is completely free of ambiguity or interpolation errors. It is an ideal choice for instruments that must be accurately read by relatively unskilled personnel such as medical instruments and power control instruments used in factories etc. The large bright size of the digital display facilitates reading of the display from long distances under almost any lighting condition

DPMs also offer data outputs which can be interfaced to printers, teletypewriters or computers for data logging or processing.

However, the analogue meter has a major advantage in that a skilled operator can effectively control a particular equipment by observing the acceleration and fluctuations of an analogue meter. Anticipatory adjustment and control often makes an analogue meter display absolutely essential. For example, in an aircraft, most of the displays are of the analogue type where the pilot is dependent on the movement of the pointer to indicate to him the variations in different parameters of the aircraft.

The trend in today's instrumentation is however towards digital readouts. A major reason, other than the performance advantages of the DPM over the analogue meter, is the DPM's aesthetic beauty and customer appeal.

A DPM consists of four basic functional sections: (i) processing of the input signal; (ii) conversion of analogue to digital signals; (iii) the display section; and (iv) the power supply.

Processing the input signal: The main function of this section is to buffer the input to provide a high input impedance, prevent circuit damage in over-voltage conditions, reject both normal and common mode noise on the input signal and compensate for large variations in operating temperature.

Conversion of analogue to digital signals: The analogue to digital converter conversion scheme used in most DPMs is the dual slope type, due to its inherent stability and normal mode noise rejection.

The dual slope method of A/D conversion is the most accurate on three counts: (i) it is independent of the clock frequency; (ii) high noise rejection rate; and (iii) it is independent of capacitor value changes. A brief description of the commonly used circuit is given below.

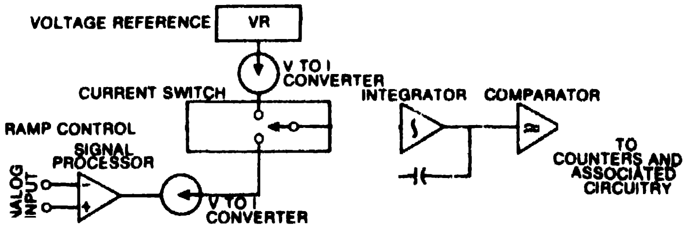

Fig. 1: Block diagram of A/D converter

In Fig. 1 the input voltage V_X is first converted to a current I_X with the help of a voltage to current converter, which is usually a bridge controlled converter. The reference voltage V_R is also similarly processed such that I_R is always opposite in polarity as compared with the analogue input.

At time $t = t_0$, the ramp control switch allows I_X into the integrator, which allows the current to rise with a linear slope for a fixed period $t = t_0$ to $t = t_1$ (T_1). The current I_X rises to a value depending upon the value of the input voltage V_X. (The maximum value and the minimum value that I_X can take are shown in Fig. 2.) At T_1, I_X is switched off and I_R is now allowed into the integrator. I_R, because it is opposite in polarity with I_X, now decays down to zero with a linear slope. The period T_2(period from t_1 to t_2) is dependent on the value of the input voltage because I_R decays down from a height determined by the input voltage V_X. The output of the integrator is fed to a comparator and the comparator output is fed to a digital counter etc. The period T is now available in the counters as a count. Since T_2 is proportional to V_X, the input voltage, the input analogue voltage is now available in digital form.

Since T_1 and T_2 are derived from the same clock frequency, the digital output is independent of the clock frequency. Also, since integration is done over two periods, the changes in the capacitor value do not affect the output.

Display section: Once the input signal is digitised, it is decoded and displayed on a digital readout. Numerous types of displays are available; the commonly used in recent days being the LED display and the Beckman or fluorescent tube displays.

The light emitting diodes are available in a wide range of colours, including green and blue, up to sizes of 13 mm. These are the ultimate in ruggedness, reliability and aesthetic appeal.

The commonly available fluorescent tube displays are 5-digit packages with a plus sign available at the left hand side to indicate polarities. These offer easy reading in direct sunlight and are available in green readouts.

Power supply: The latest concept in DPMs power supply is to use +5V DC supplies which are available, in most cases, in instruments and systems powering standard logic circuits. By operating the DPM from the +5V power supply, no AC transformer is required and the height, weight and size is greatly reduced. The internal heat rise is minimised.

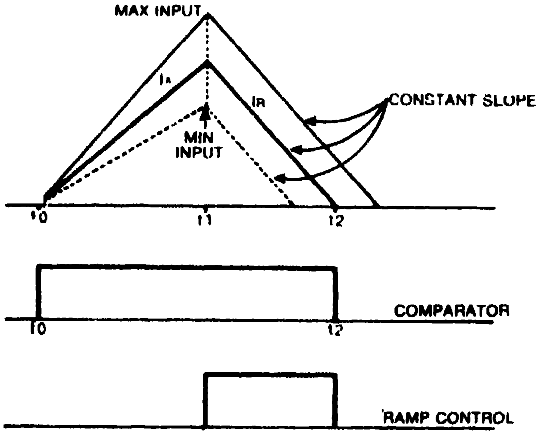

Fig. 2: A/D converter waveforms

The logic powered DPM has a greater isolation from line variation noise and transients since it is operated on regulated power, and no AC power lines need be routed to the front panel of the instrument or system. Logic powered DPMs are safer also, since no high voltages are required.

Errors in a DPM

Independent of temperature, there are three components which lead to DPM inaccuracies.

Zero offset error: Zero level offsets in analogue circuitry cause errors specified as a percentage of full scale reading. These errors can be corrected by a zero calibration potentiometer requiring periodic resetting.

Gain variations: These occur as a function of signal level in the analogue circuitry and produce errors which are specified as a percentage of the reading. These are usually difficult to design out of a DPM circuit, but can be minimised by strict component selection and specification.

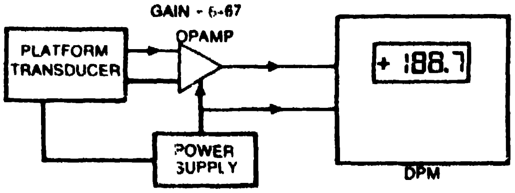

Fig 3· Digital platform weighing scale

Digital indecision: In any digital device with a counter and clock, there is always a probable ± 1 count error in the output.

Uses of the DPM

Typical applications of the DPM include: (i) measurement of physical parameters such as temperature, pressure, weight, liquid level, pH etc; (ii) systems applications providing digital readout, automatic data logging and digital feedback control; and (iii) precision differential measurement.

A typical application of the DPM is the digital weighing platform scale. Platform transducers can be used to measure loads of up to 1000 lbs. These transducers are strain gauge elements usually connected in bridge form. They provide output of 15 mV at full scale load with 10V excitation. By using an opamp to provide a gain of 6.67, a 1000lb load will produce an analogue DC output of 100mV. These can be directly fed to a 3½-digit DPM and the output will be in pounds (Fig. 3). □

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DIGITAL FILTER AND ITS SYSTEM HARDWARE CHOICE

K.Kalidas

The advent of integrated technology has brought with it a new revolution in the realisation of real time digital filters. This article attempts to present briefly the advantages of digital filters.

It also indicates with the help of an example the technology and hardware involved, and the different choices available for selecting the system hardware for different applications of the digital filter.

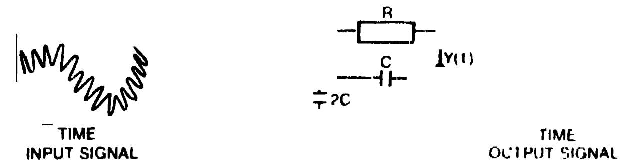

Fig 1 Twin-T network

Advantages of digital filters

Digital filtering is a computational process or algorithm by which a sampled analog signal or sequence of numbers acting as an input is transformed into a second sequence of numbers called the output. During the computational process, the input is altered or a portion of it is rejected to have integration, differentiation, high-pass, low-pass and band-pass or band-stop, filtering actions. At the end of the process, the processed new signal is converted into an analog signal producing the filtered version of the original signal.

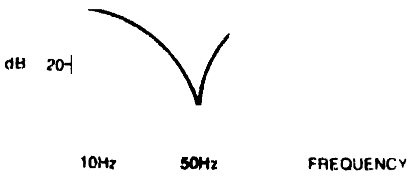

Fig. 2:Characteristic curve of the twin-T network

The advantages of the digital filter over the analog filter can be listed as follows:

1. There is no change in the performance of the digital filter due to a change in the values of the components caused by temperature and aging effects.
2. The performance is stable and repeatable from one unit to another.
3. Periodic calibration is not required.
4. The response of the digital filter can be altered very easily by changing the sampling rate or arithmetic coefficients etc.
5. High precision can be achieved by using high precision arithmetic hardware techniques.
6. Using custom-designed LSI techniques, it is possible to have very small, low-power and low-cost digital filters.

A band stop digital filter

In order to give an idea of the technology, architecture and flexibility of the digital filter, an example of a band-stop filter can be given.

A signal of frequency 10 Hz containing a strong unwanted mains supply frequency of 50 Hz is assumed. The aim is to eliminate the 50Hz interference from the signal.

The popular analog filter to eliminate 50Hz interference from the signal is a notch filter or a band-stop filter. In the analog circuit, this can be achieved by a twin-T network as shown in Fig.1. The characteristic response of the twin-T is shown in Fig.2, with the notch centre frequency at 50 Hz.

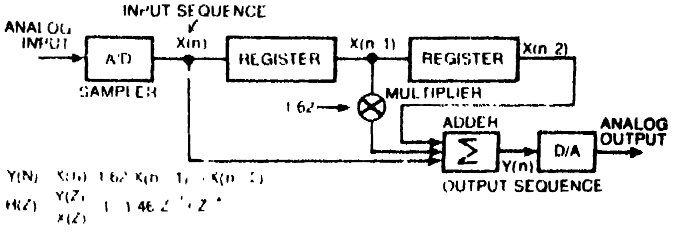

Fig 3: Band stop digital filter

In this example, in order to change the centre frequency of the twin-T network, it is required to change the value of either the resistance or the capacitance or both. Also, the position and depth of the notch is very sensitive to parameter changes in the components of the network.

The solution to the above problem can also be obtained by a digital filter which is more flexible. Fig.3 shows the hardware of the digital counterpart of the twin-T network. It consists of a sampler, registers, a digital multiplier, a three-input adder and a digital to analog converter. The analog input signal is sampled by the A/D converter at the rate of 500 samples/sec. The input sequence x(n) (after quantisation) thus obtained is processed according to the difference equation as shown in Fig. 3. The current output sample word [Y (n)] is formed by adding the current

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input sample word [X (n)] with (i)the previous input [X(n-1)] multiplied by the constant -1.62, and (ii) with the second previous input [X(n-2)].

When the same signal of 10 Hz contaminated by 50 Hz is applied to the digital filter with the sampling rate of 500 samples/sec, the regenerated analog output signal will be free from 50Hz interference as shown in Fig.4. The input and the output sequence of the filter is as shown in Fig.5. The output sequence can be verified with the help of a calculator or computer which generates the input signal and computes the output sequence Y(n) according to the difference equation shown in Fig.3.

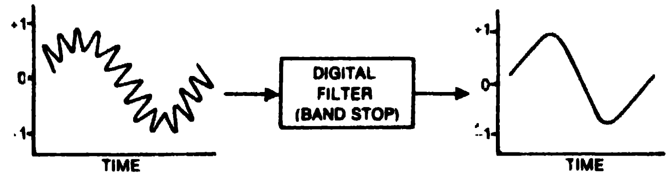
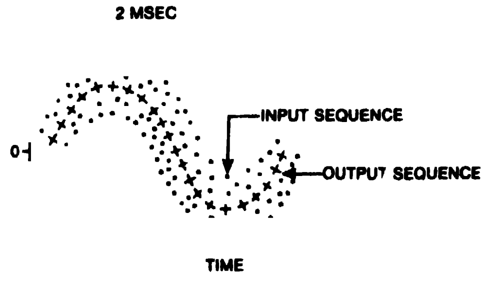


Fig. 4

The digital filter response remains constant and does not drift with temperature or age. The notch centre frequency of the digital filter can be changed easily by two ways. For example, changing the coefficient -1.62 to -1.46 changes the notch centre frequency to 60 Hz. The second way is to change the sample rate. In this example, increasing the sample rate to 600 Hz shifts the notch centre frequency to 60 Hz.

Choice of technology

The choice of technology is determined by the sample rate required. For example, the microprocessor is a popular choice for lower sampling speeds. However, the main drawback of the microprocessors is their very poor speed. This is mainly due to the indirect and step-by-step manner in which they operate. They can therefore be used for dedicated systems where high speed is not required — for example, in seismology, and medical and biological electronic applications. The choice of the microprocessor will also be dependent on the application of the filter, word length, processing speed, system complexity etc.



'Fig. 5

The second choice in technology (also called discrete component technology) is whether or not to use the TTL logic family and its derivatives. This logic family is useful where a very high sampling frequency is required — for example, sampling frequency of about 250k samples/sec or so. Included in this category is the use of n-bit slice processors, since they generally operate under fairly dedicated conditions.

The third choice is between the use and non-use of custom-designed LSI circuits. The cost of the custom-designed LSI should be considered as compared to other technologies. Since the cost of extra hardware for example power supplies, PCBs, connectors etc involved in other technologies are reduced to zero in LSI circuits, low cost can only be achieved by means of a completely customised design.

Choice of architecture

There are many architectures available at present to realise the digital filter system. The optimum architecture depends on the application of the filter. For example, for a high speed processor, parallel arithmetic can be considered, whereas for lower speeds, serial arithmetic will be simpler and economical.

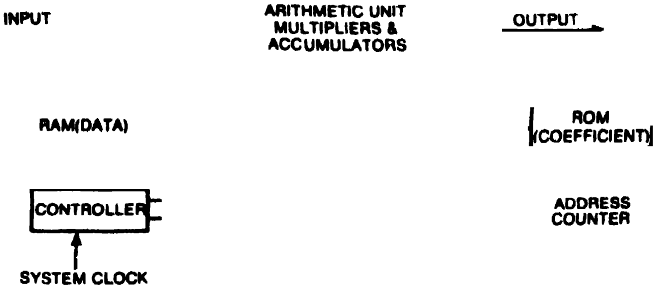


Fig 6: Example of multiplexed system

In the case of a cascaded digital filter, it is also possible to use a single multiplier to perform different multiplications. The multiplier can take the coefficients to be multiplied with the data input one after another, by the multiplexing technique as shown in Fig.6.

In the case of a dedicated system, it is advantageous not to use the multiplex technique. The coefficients can be loaded permanently in the multiplier.

Choice of multiplier

The multiplier is the most complex functional block in a digital filter. Hence, a proper design technique will save hardware and increase the speed of process. The multiplication techniques available at present include all-parallel, all-serial and serial/parallel methods.

Parallel multiplication is a fast and simple technique for storing all 2^{M+N} products of an M-bit by N-bit multiplication in a memory. However, as M and N increase, the storage increases exponentially, which limits the capability of the technique.

Serial multiplication is the slowest of all multiplication techniques, but considerable hardware is saved by this method. As shown in Fig.7, the input A is loaded into the register A, which recirculates the data into the system once it is completely loaded. As it recirculates, the data is gated into a previously cleared accumulator, word by word, by every bit in input B. The partial product is added to the accumulator B during each recirculation of data in register A. The next bit of input B is then shifted into the multiplier and the process is repeated.

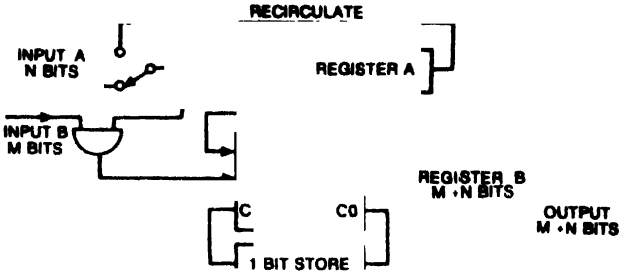


Fig 7 Serial multiplier

The serial/parallel multiplication is also known as the pipeline multiplier. In this technique, one input is serial and the other is parallel. The serial data is used (LSB first) to gate the parallel data into a series of adders as shown in Fig. 8.

The partial products are shifted along synchronously with the incoming serial data and are sequentially summed. The time taken for such M x N bit multiplication is M+N clock cycles. The time can be reduced by splitting the data into nibbles, processing these in parallel, and finally summing the four partial products. This technique reduces the processing time to some extent.

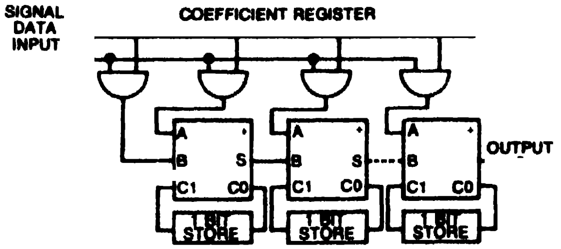


Fig 8

Choice of arithmetic

The choice of arithmetic mainly depends on the application, i.e. the type of signal to be processed and information required at the output. If, for example, the signal-to-noise ratio required at the output is considerably less than the total dynamic range of the input signal, then the floating point or non-linear arithmetic may be considered.

Overflow condition

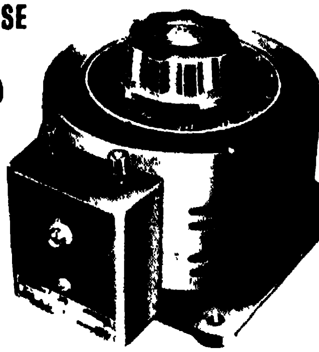
The overflow in arithmetic poses a severe problem in digital filters. The overflow not only distorts the output, but in the case of the recursive filter, the successive overflow in the arithmetic produces a sustained oscillation. The overflow can be detected by adding a saturation unit after the accumulator and it can be corrected by substituting the appropriate scale factor.

Limit cycle

Another important problem associated with the digital filter is the small-signal limit cycle. This is a non-zero output condition when the input is zero, and is caused by truncation or rounding of the results of arithmetic operations.

The truncation of the data produces a noise in the filter which is called the self noise of the filter. The self noise is simply added to the sample, producing erroneous output. The limit cycle or the non-zero output can be either constant value or oscillating in nature.

The one way to reduce the limit cycle is to truncate the magnitude of the data once only, after the accumulator, and not to truncate the individual products before the accumulator. ☐



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UNDERSTANDING TTL LOGIC

G. L. Kataria

In the field of digital electronics, there have been, in recent times, a number of additions to logic families. Each new family has had some positive features along with some negative features to be overcome by yet another upcoming new family.

Comprising the DCTL (direct coupled transistor logic), RTL (resistor transistor logic), RCTL (resistor-capacitor transistor logic), DTL (diode transistor logic), TTL (transistor transistor logic), ECL (emitter coupled logic), CMOS (complementary metal oxide semiconductor), IIL (integrated injection logic) and the V-MOS (known by its internal structure in the shape of the alphabet V) families, the logic families have grown up to be a big clan, with each family having its own good and bad features. If one broadly compares the merits and demerits of these logic families as regards cost, speed of operation, power dissipation etc, one finds that the TTL family is a good choice for most applications.

The TTL series of integrated circuits are manufactured by a large number of semiconductor device manufacturers all over the world and have been accepted as some sort of a standard series. Although some parameters of the TTL ICs vary from manufacturer to manufacturer for the same type, all of them have the same basic characteristics.

Owing to its wide popularity and use, it is necessary for the electronics hobbyist or anyone using the TTL series ICs to be conversant with some of the series' important characteristics, loading rules etc. This will facilitate the best possible use of the ICs and will minimise damage.

Before proceeding further, it will be worthwhile to have a look at the operation of basic TTL NAND gate. This gate is shown in Fig. 1. For a logic '0' output all the inputs must be at logic '1' and for any input at logic '0' the output will be logic '1' — this is the basic NAND gate operation.

These properties are obtained in the basic TTL gate as follows. The input side is composed of the multi-emitter transistor T1 which has as many emitters as the number of inputs. The transistors T3, T4 make up the output drive circuitry. If both the inputs, A and B, are held at logic 1 level, the respective emitter base junctions of T1 are reverse biased. The resistance R1 causes T2 base current to flow through the forward-biased collector base junction. It also causes T2 and T3 to saturate, resulting in a logic '0' output, which is the V_{CEsat} (the collector to emitter saturation voltage) of T3. In this case T4 will remain cut off. This condition is ensured by the diode D which raises the emitter potential of T4. But if any of the inputs A or B (or emitters of T1) are held at logic 0, then T1 becomes forward biased and saturates causing T2 and T3 to cut off.

The high voltage at the collector of T2 causes T4 to conduct, effectively acting as an emitter-follower and giving a logic 1 output. The T3-T4 pair forms the 'rotem pole' or 'active pull-up output', which provides a low driving source impedance permitting a light capacitance load to be driven without seriously affecting the switching time. As discussed above, the output has a low impedance because of the emitter-follower action of T4 at logic 1 output and at the same time low saturation resistance of T3 at logic 0 output.

Some important basic characteristics of the TTL logic family, a knowledge of which will ensure effective utilisation and minimum damage of TTL ICs, are outlined below.

Transfer characteristics

The input and output logic levels for the TTL series are given keeping in view the fact that any such logic gate driving another of the similar type ensures smooth and efficient working.

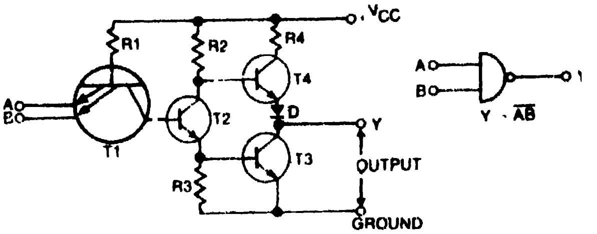

Fig 1 The basic TTL NAND gate and its logic symbol

V_{IL} or input voltage required for effecting a logic low or logic 0: The typical maximum voltage that can cause a logic 0 at the input is 0.8 V. This means that any voltage up to 0.8 V can be used as a logic 0 at the input side.

V_{IH} or input voltage required for effecting a logic high or logic 1: The typical minimum voltage that can cause a logic 1 at the input is 2 V. This means any voltage below the supply voltage up to 2 V can be used as a logic 1 at the input side.

V_{OL} or output voltage level in the logic low or logic 0 state: The typical maximum voltage level at the output during output logic 0 condition is 0.4 V. This means that at logic 0 output the maximum voltage that will appear at the output is 0.4 V

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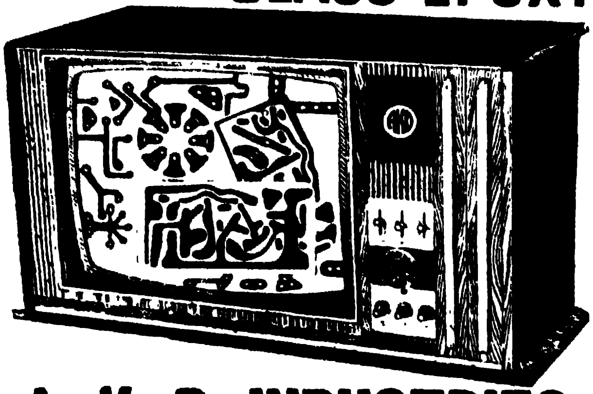

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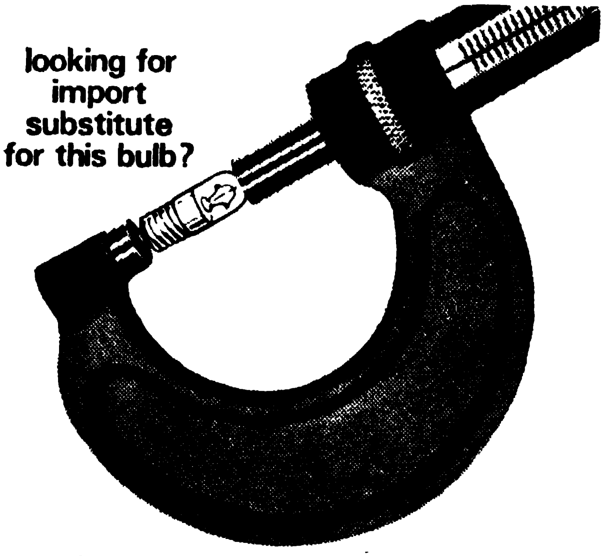

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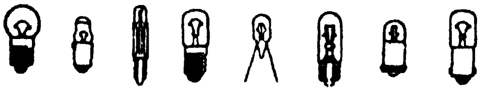

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V_{OH} or output voltage level in the logic high or logic 1 state: **The typical minimum voltage level at the output during output logic 1 condition is 2.4 V. This means that at logic 1 output, the minimum voltage that will appear at the output is 2.4 V.**

It can be seen that there is a difference of 0.4 V between V_{IH} and V_{OH} and between V_{IL} and V_{OL}. This is known as the DC noise margin.

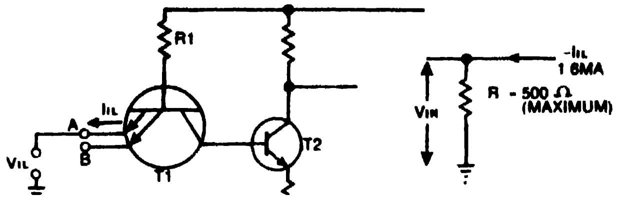

Fig. 2. Outward flow of I_{IL} at logic O input

Input characteristics

Besides the input logic levels V_{IL} and V_{IH}, it is also necessary to have an idea of as to how much current flows into or out of the terminals in the input side. Unless the required values of current flow during input logic applications within the rated limits, the TTL devices will not function satisfactorily. The following typical values are involved corresponding to application of logic 0 or logic 1 in the input side:

I_{IL} or input current at logic low or logic 0 condition: **The typical value of I_{IL} per input is 1.6 mA, and this current flows out of the concerned input and hence is designated as a negative value (as shown in Fig. 2). The polarity is not usually indicated in the data sheets, but it should always be kept in mind that I_{IL} flows out of the concerned input terminal. Because of the typical value of I_{IL} as 1.6 mA, a limitation is imposed in the input side. This is that the effective resistance between the concerned input and ground should not exceed in any case 500 ohms, otherwise it will result in increasing the input voltage V_{IN} above the maximum value of V_{IL} (0.8 V) and thus cause an incorrect logic.**

I_{IH} or input current at logic high or logic 1 condition: The typical maximum value of I_{IH} per input is 40µA, and this current flows into the concerned input as shown in Fig. 3.

Output characteristics

Corresponding to the output logic levels, V_{OL} and V_{OH}, there are limitations in the currents which the typical TTL gate can source (supply) or sink (accept).

At a logic 1 output, the maximum current that can be drawn from the output without lowering the value of V_{OH} is typically 400µA, and at logic 0 output the maximum current that the lower transistor (T3) of the totem pole pair can sink or allow to pass through without increasing th value of V_{OL} is typically 16 mA. From these values it is clea that we can safely connect ten identical gates at the outpu of the basic TTL gate without seriously affecting the func tioning within the ratings.

In data books, instead of giving the values of input an output currents, it is customary to treat the typical inpu current I_{IL} and I_{IH} of the TTL logic as a standard TT load. The output values of the currents divided by th standard TTL load thus gives the number of such loads tha can be safely connected.

Summing up from the above typical values we see tha the number of TTL loads that can be connected to th standard TTL logic is 10 (16mA/1.6mA and 400 µA 40µA). This load data is characterised as the 'fan-out' o the gate. Thus a fan-out of 8 means eight TTL loads or th output currents I_{OH} = 8x40µA = 320µA an I_{OL} = 8x1.6mA = 12.8mA. Thus, one thing which has to b borne in mind whenever a new logic circuit is developed i that the loading should be well below the fan-out mentioned in the data book for the circuit to function properly.

Switching speed

The switching speed of TTL logic is characterised in tw parameters of propagation delay or, in other words, in th time taken in the transfer of action at the output for som change in the input. Two types of transitions can occur the input — the logic level changing from 'zero' state t 'one' state and from 'one' state to 'zero' state.

The propagation delay for the transition from zero to on (or low to high) at the input is termed as t_{PLH} and th propagation delay from the transition from one to zero (high to low) at the input is termed as t_{PHL}. The typical valu

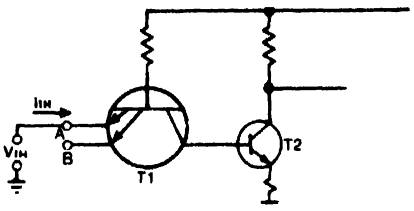

Fig. 3. Inward flow of I_{IH} at logic 1 input.

of t_{PLH} is ≤22 ns and of t_{PHL} is ≤15ns. These values are governed by some external factors such as ambient ten erature, effective value of capacitance at the output l and supply voltage.

The values of t_{PLH} and t_{PHL} impose a limitation on maximum rate of input switching because any pulses hav widths lower than the given t_{PLH} and t_{PHL} will not propag the required transitions at the output without affecting their width characteristics.

DC noise margin

The DC noise margin is the difference between V_{OH} and V_{IH} (known as high level margin) and also the difference between V_{IL} and V_{OL} (known as the low level margin). As already given above, the difference in both the cases is 0.4 V and is a safety margin. The high level noise margin assures that any logic 1 generated by an output will be recognised as a logic 1 by any input it is connected to. Similarly, the low level noise margin assures that any logic 0 generated by an output will be recognised as a logic 0 by any input it is connected to.

Supply characteristics

The power supply requirements of the TTL family are a bit rigid. Though the TTL ICs function well within the power supply voltages of 4.5V to 5.5V, a nominal supply of 5V is generally recommended. The supply should have a good degree of line and load regulation characteristics, and a very low value of ripple voltage. Regulated supplies with overload and short circuit protections are preferable.

Because of the higher switching speeds of the TTL logic, it usually becomes necessary to decouple the supply nearer to the supply terminals of the TTL ICs, so as to suppress the voltage transistors in the supply voltage. Otherwise the transients cause a malfunctioning in the other stages used in the circuit. Generally a 0.1µF disc ceramic condensor is sufficient for a single TTL device.

Sometimes, it also becomes necessary to take care of the unused inputs of all TTL devices used in a circuit so as to minimise noise sensitivity and optimise switching times. In such cases, all unused inputs of TTL circuits should be held between 2.4 V and the absolute maximum 5.5 V.

Theoretically, an unconnected input assumes the logic 1 level, but practically it is an undefined logic state because it tends to act as a receiving antenna for noise. Only a few hundred millivolts of noise can cause the unconnected input to go to the logic 0 state. As TTL devices can functionally store logic levels such as flip-flops, latches, registers, counters etc, it is important to terminate unused inputs properly since a noise spike on these inputs might change the contents stored in the IC. Leaving unused inputs floating can cause malfunctioning in a circuit, even if it has been designed properly. The following important steps should be followed regarding unused inputs:

1. Connect unused NAND OR, AND gates (with multi-emitter inputs) to a used input of the same gate, keeping in mind that the logic 1 level fan-out of the driving circuit is not exceeded. It should be noted that by the above method there is hardly any effect on the logic 0 level fan-out, because all such inputs share a common-base pull-up resistance R1.

2. Tie unused NOR or OR inputs to ground (or logic 0 level) or connect them to a used input of the same gate, provided the fan-out of the driving circuit is not exceeded.

3. To provide a permanent logic 0 on an input, connect it to ground.

4. To provide a permanent logic 1 on an input any of the following steps may be followed:

(a) Connect the input to Vcc (the positive supply voltage of the TTL logic) taking care that it never exceeds the absolute maximum value of 5.5 V, even for a few nano seconds, because the input circuit may break down on application of a voltage level greater than 5.5 V, causing the device to be damaged permanently.

(b) Connect the input to Vcc through a current limiting resistance of approximately one kilohm. A common resistance may be used to connect up to 50 inputs.

(c) Connect the input to a separate power supply of 2.4 V to 5.5 V, if available.

(d) Connect the input to the output of a spare gate that has a logic 1 state permanently at the output. Any spare NAND/NOT gate can be used by simply grounding one of its inputs, thus resulting in a logic 1 output.

In addition to the stringent requirements of the power supply, a good ground system is also essential for a printed circuit board containing a large number of TTL ICs. The ground can either be a good ground bus or a ground plane. Ground loops on or off the PCB should be avoided, unless they simulate the effect of a ground plane.

Sometimes it becomes necessary to increase the fan-out beyond the rated values. In such cases, the inputs and outputs of gates on the same package may be connected in parallel. It is advisable to limit the gates being paralleled to those in a single package. This avoids large transients in the supply voltage due to different switching times of the gates.

With the above characteristics and general precautions in mind, there is no reason why any newly developed digital circuit based on TTL devices may not function properly within the limits of its correct design. □

DIGITAL ELECTRONICS SUPPLEMENT

This issue carries the second part of the supplement on digital electronics. The first part was carried in the October 1979 issue.

CMOS COMES TO STAY

M.R. Nayak

A logic family which dissipates no power, has zero propagation delay, controlled rise and fall times, and has noise immunity (∼50% of logic swing) can be termed as an ideal logic family. The properties of CMOS (complementary metal oxide semiconductor) family tends to approach these ideal characteristics, as:

1. CMOS dissipates low power. Its static power dissipation is∼10 nW per gate (due to flow of leakage currents). Typically, gate dissipation at 1 MHz with 50 pF load is∼10 mW (active power).
2. CMOS propagation delay is small (∼ 25 to 50 ns).
3. Rise and fall times are controlled, tending to be ramps rather than step functions. Typically, rise and fall times tend to be 20 to 40% longer than the propagation delays (Fig. 1).
4. The noise immunity approaches 50% of the full logic swing. The noise immunity is the worst-case input voltage levels which will maintain guaranteed output conditions and will not produce a change in logic state.

CMOS devices

CMOS logic circuits employ both p-channel and n-channel enhancement-mode MOS transistors. They have opposite (or complementary) switching characteristics and hence may be used as virtually ideal switching components (Fig. 2). The circuit consists of one p-channel device and one n-channel device. To form the n-channel device, a p-doped 'tub' must be created into which the device is placed. 'Channel stops' are placed between the p tub and the p drain to prevent parasitic channelling effects.

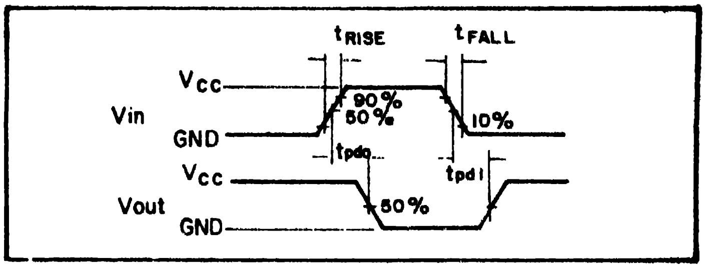

Fig. 1: Rise and fall times and propagation delays as measured in a CMOS system.

When a positive voltage V_{DD} is applied at the input, the p channel switches off and the n channel switches on. Thus, the output is connected to V_{SS} through the low 'on' resis-

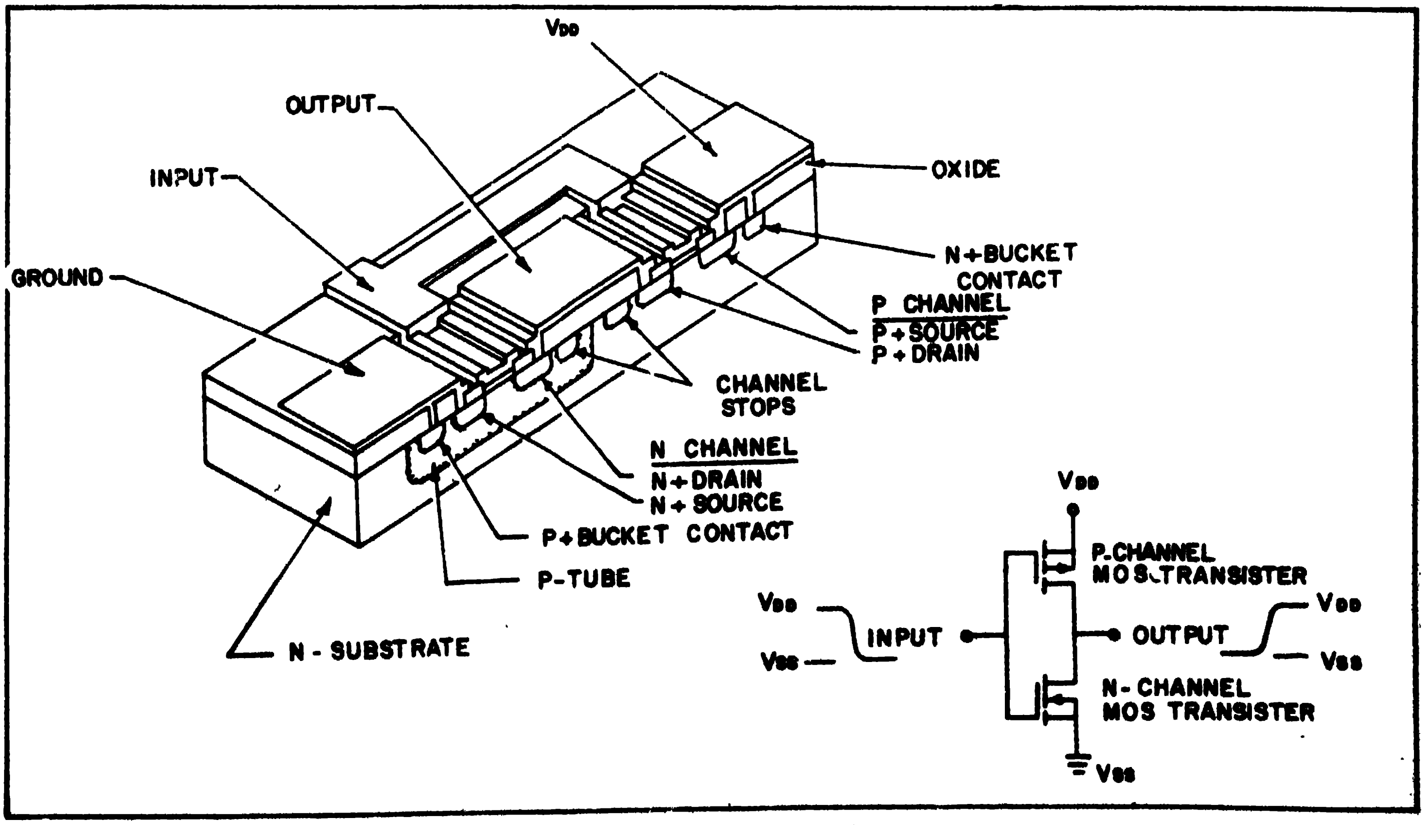

Fig. 2: The basic CMOS inverter circuit:

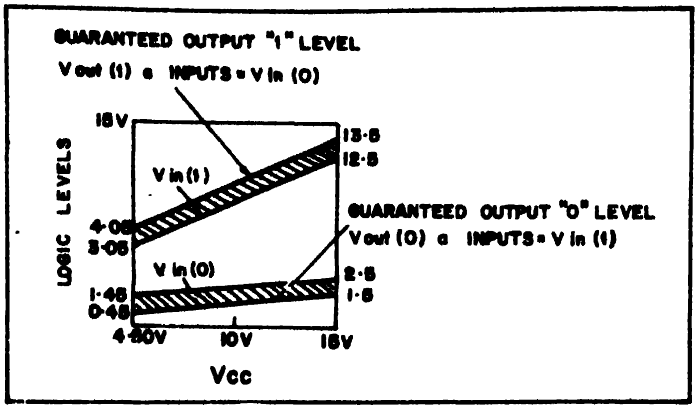

Fig. 3: Guaranteed CMOS DC margin over temperature as a function of V_{cc}. CMOS guarantees 0.1V.

tance of the n-channel device. Alternatively, applying VSS to the input turns off the n channel and turns on the p channel. In this state, the output is connected to VDD through the equivalent 'on' resistance of the p-channel device. Hence, an input voltage of VDD results in an output voltage of VSS, and an input voltage of VSS results in an output voltage of VDD. This is a simple digital inverter.

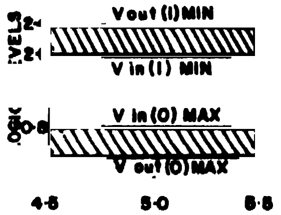

Fig. 4. Guaranteed TTL DC margin over temperature as a function of V_{cc} TTL guarantees 0.4V

CMOS considerations

The power dissipated in a CMOS circuit, when driving a capacitive load is CV^2f. For a fixed capacitive load C, increasing power supply voltage V increases the speed, but it also increases power dissipation. For a given capacitive load and switching frequency, power dissipation increases as the square of the voltage change across the load.

The guaranteed CMOS DC margin over temperature as a function of VCC can be compared as in Fig. 3 to Fig. 4. The overall effect of a temperature increase is a decrease of current. In this respect the MOSFET differs from the bipolar transistor, where an increase in temperature increases the current—both because the current gain h_{FE} increases and because the junction voltages decrease.

CMOS devices need careful handling considerations. Following precautions are necessary to assure trouble-free performance after assembly:

1. Use a conductive, grounded work surface.
2. Keep operators at ground potential.
3. Unused inputs should not be left open.
4. Invert CMOS devices last to avoid overhandling.
5. Don't use nylon smocks.
6. Use conductive or anti-static envelopes for storing—never use untreated plastic.

The advantages of CMOS over other logic families are:

1. Low power, medium speed, high noise immunity.
2. Directly compatible with TTL ICs.

These advantages can be verified from the data given in Table 1. □

TABLE 1
A Comparison of Common Digital IC Families

Parameter	*DTL*	*TTL*	*CMOS*
Function (+ve logic)	NAND	NAND	NAND
Z_{out} (1) (ohms)	2K	70	1.5K
Z_{out} (0) (ohms)	R_{sat}	R_{sat}	1.5K
Fan-out	8	10	50
Supply voltage (V)	5	5	3 to 20
P_{diss} (watt)	8	10	0.01 (Static)
Noise margin (min)	700 mV	400 mV	0.3 VDD
Noise generation	medium	high	low
Prop delay/gate (Ns)	30	10	70
Speed-power products (pj)	240	100	0.7
Cost/function	Low	Low	Medium

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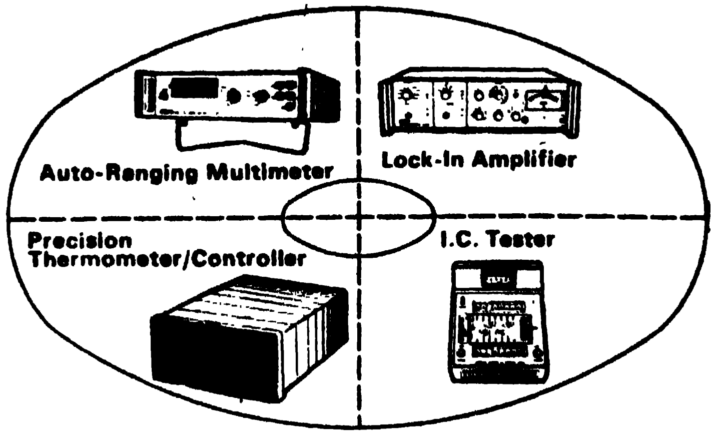

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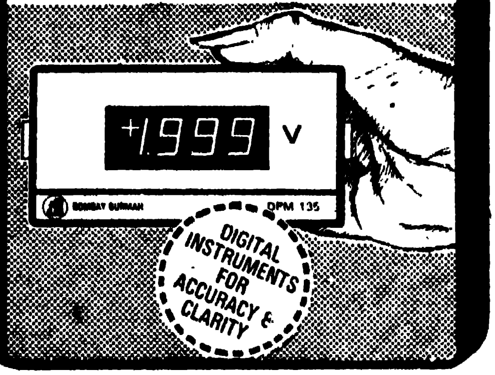

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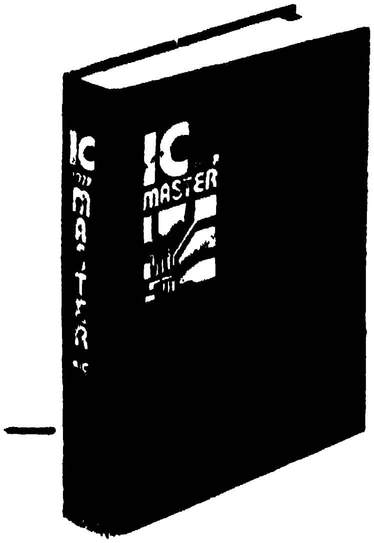

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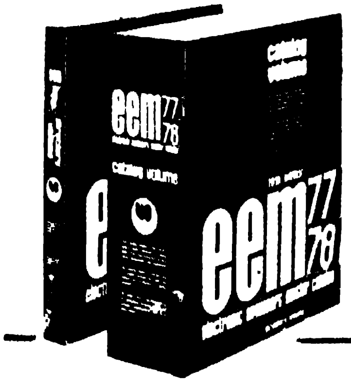

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CHARGE COUPLED DEVICES in Memory Systems

Anirban Basu

Memory systems based on charge coupled devices are bound to have wide applications within the next few years. Charge coupled device secondary memories are already being offered commercially, but CCD memories are likely to prove useful also for primary storage — the main memory of a computer.

First announced by Bell Telephone Laboratories in early 1970 as a new concept in MOS integrated circuit devices, the CCD is a shift register for analogue signals that is constructed from a string of MOS capacitors. Its primary advantage is high storage density—much greater than that of a MOS RAM, yet potentially at a much lower cost per bit.

CCD technology

CCD as a serial shift register, might be visualised as a set of flip-flops organised serially, through which information is propagated bit by bit at a rate established by an external clock. However, CCD is not actually a series of flip-flops. In contrast to a digital shift register, bits stored in the CCD are represented by variable quantities of electrical charge, rather than on-off states of fixed magnitude.

A circuit analogy (Fig.1) is a set of RC networks (or charge cells) coupled by amplifiers that are activated by clock pulses. A clock pulse gates the charge of each capacitor cell into the successive amplifier; the amplifier, in turn, charges the next cell accordingly.

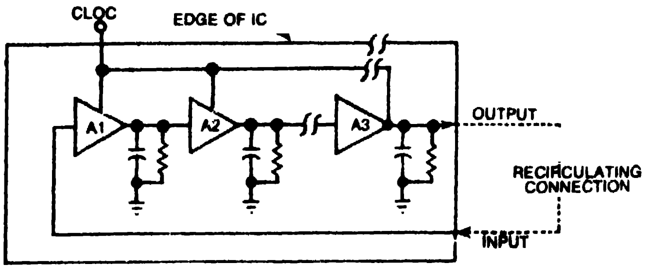

Fig 1

In reality, the CCD is a linear array of closely spaced MOS capacitors. As in most MOS structures, the gate is of aluminium and the insulating layer is of silicon oxide (Fig. 2). When a positive voltage is applied to the gate, the majority carriers, which are holes in the p-type substrate, are repelled from the vicinity of the gate, forming a potential well under it, storing a negative charge packet. This charge gradually dissipates, and must be periodically refreshed or regenerated to retain the charge signal.

The depth of the well is a function of the gate voltage; the higher the voltage, the deeper is the well. As minority carriers (the charge) are introduced into the potential well, they reduce its depth, just as a fluid fills up a container. The amount of charge in the charge packet distinguishes between a logical one and a logical zero.

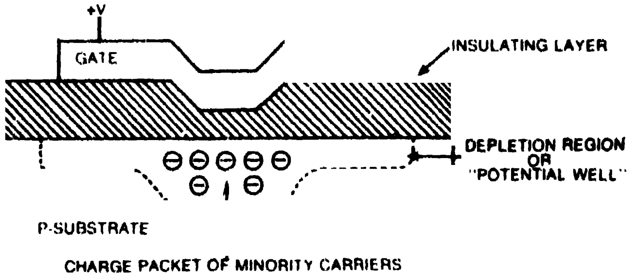
+V
GATE
INSULATING LAYER
DEPLETION REGION OR "POTENTIAL WELL"
P-SUBSTRATE
CHARGE PACKET OF MINORITY CARRIERS

Fig 2

Charge Injection in CCD

As illustrated in Fig. 3, charge can be injected in the following way. The diffused p-region serves as a source of minority carrier holes which are transported to the first element of the CCD array. An alternate method involves minority-carrier generation under the CCD electrodes by incident light. This feature enables use of CCDs for image storage.

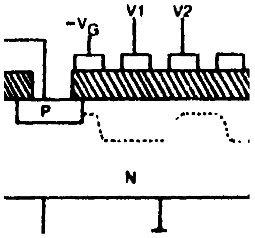

Fig. 3

Charge detection

A method of detecting charge at the output of the CCD array is illustrated in Fig. 4. A diode at the end of the array is reverse-biased to voltage Vo. Vo is more negative than any of the surface potentials used for transfer. When charge, in the form of holes, is transferred to the p-region, an output current I_s is produced and an output voltage is

---

Mr Basu, an M. Tech. in Electronics, is presently working as a trainee computer engineer in the Indian Statistical Institute. The project he worked on for obtaining his master's degree related to digital instrumentation.

developed across R. In n-substrate, minority carriers are holes.

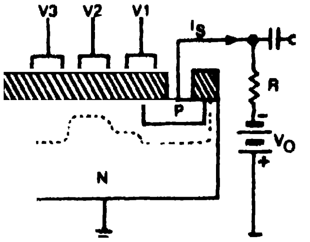

Fig. 4

Charge transfer process

Fig. 5 shows a linear array of closely spaced MOS capacitors. A three-phase clock signal is used and every third capacitor is connected to the same phase. The drive voltages are shown in Fig. 6. If wells of different depths are spaced closely, they overlap. Fig. 7 shows the potential well shape at the three points of time defined in Fig. 6.

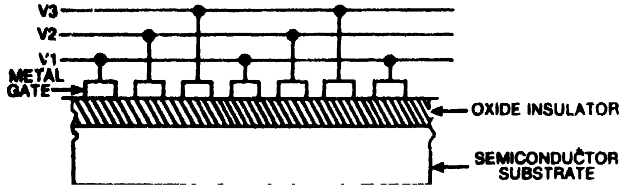

Fig. 5

At t1, a potential well is associated with V3 gates only. A charge packet previously infected from an external source can be stored in any of the three wells. One such packet is shown in the figure. At t2, a potential well forms under V1 gates, while the wells under the V3 gates begin to shrink. As a result, the charge packet begins to flow from the V3 gate to the neighbouring V1 gate. At time t3 the charge transfer is complete.

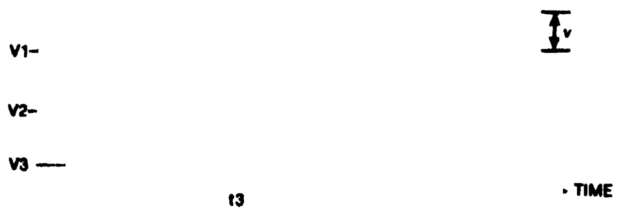

Fig. 6

It is easily seen that the three voltages interact in such a way that they effectively cause the potential well containing the charge packet to move linearly along the cell array. The period of the drive voltages determines the basic shift period and hence the speed of operation of CCD memory. In this case three adjacent cells are needed to store one bit of information.Two- or four-phase operation is also feasible, the principle being the same as with three-phase.

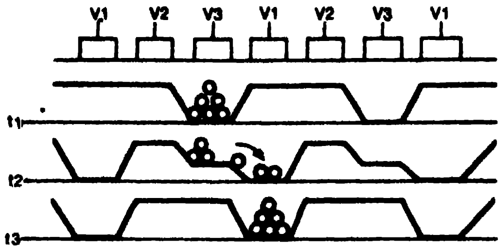

Fig.7

CCD memory organisation

Various organisations have been proposed and developed for CCD memory construction. The choice depends on the desired system performance. The frequency of the clock that shifts data through the CCD shift register can have a wide range, limited at one extreme by the circuit's maximum switching speed, and at the other by maximum allowable refresh time required to maintain the data bits.

Three basic organisations have been evolved:

1. Synchronous or serpentine organisation: In this storage cells are laid out along a winding path with signal refreshing stages at each corner (Fig. 8) All bits traverse the same path through the loop at the same frequency. Each bit passes through every storage element in one trip through the device. This type of layout moves data from cell to cell and from register to register in one continuous stream. It has the longest access time and the highest power dissipation.

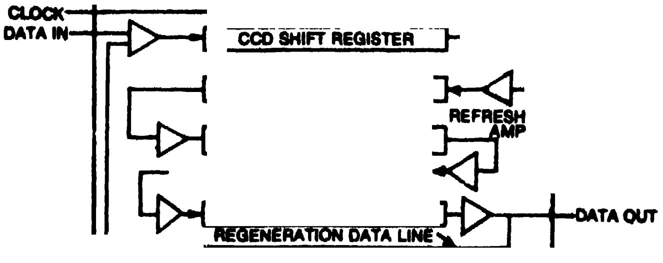

Fig. 8

2. Series-parallel-serial (SPS) organisation: Two single-channel serial shift registers of N bits serve one large multichannel shift register consisting of N serial registers operating in step. A series of bits is fed into the input shift register at a high rate, then transferred in parallel into the multichannel register, and fed out through the other serial register. As shown in Fig. 9, it requires two clocks — one fast and one slow.

3. *Line addressable random access memory (LARAM) organisation:* This combines CCD and MOS concepts to provide for shorter access time. It has MOS address selection matrix and a number of CCD serial shift registers or lines. As the name implies, any line is randomly accessible, but its contents are accessible only serially as shown in Fig. 10.

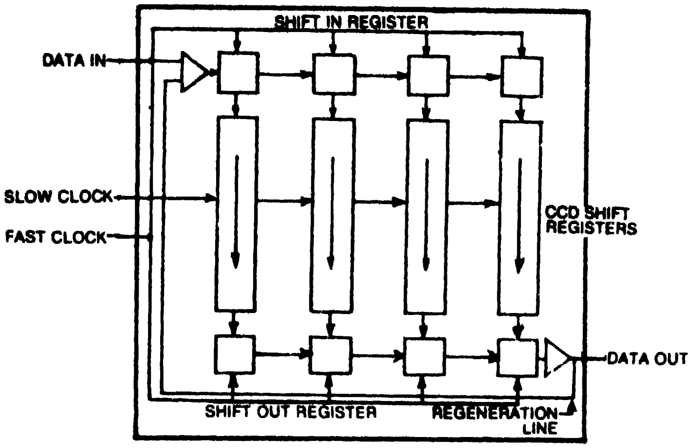

Fig. 9

In this organisation, parallel storage registers circulate data individually and are separately addressible at random.

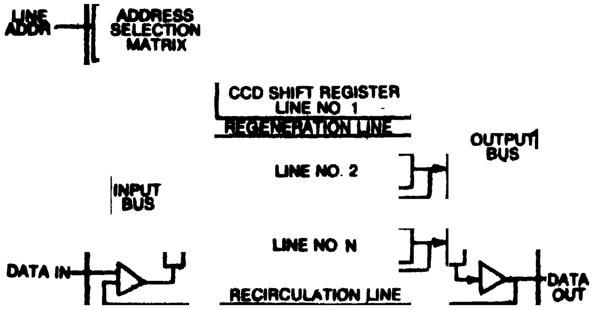

Fig. 10

When a given line is addressed, a fast clock is applied to that line. Data is read or written only in that line.

CCD memory chips available

As the cost of CCD memories decreases, a greater variety of charge coupled devices will become available. Fairchild, Intel entered the market a few years ago.

Semiconductor RAMs are fast but costly; magnetic electromechanical devices are cheap but slow. CCDs have potential to fill the gap between these technologies in cost, capacity, and access time. □

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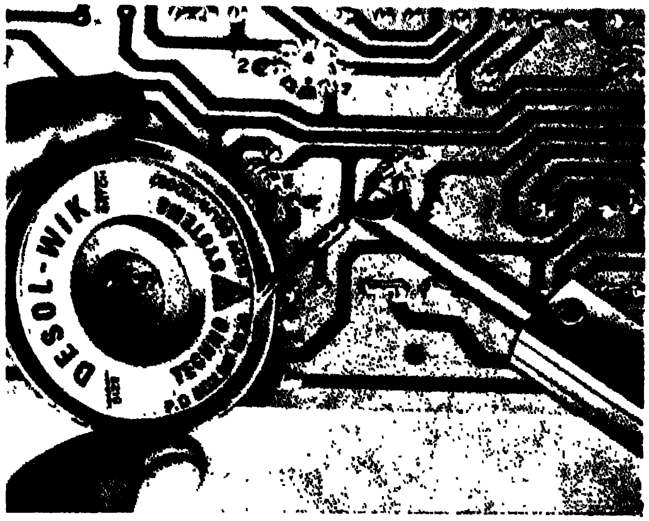

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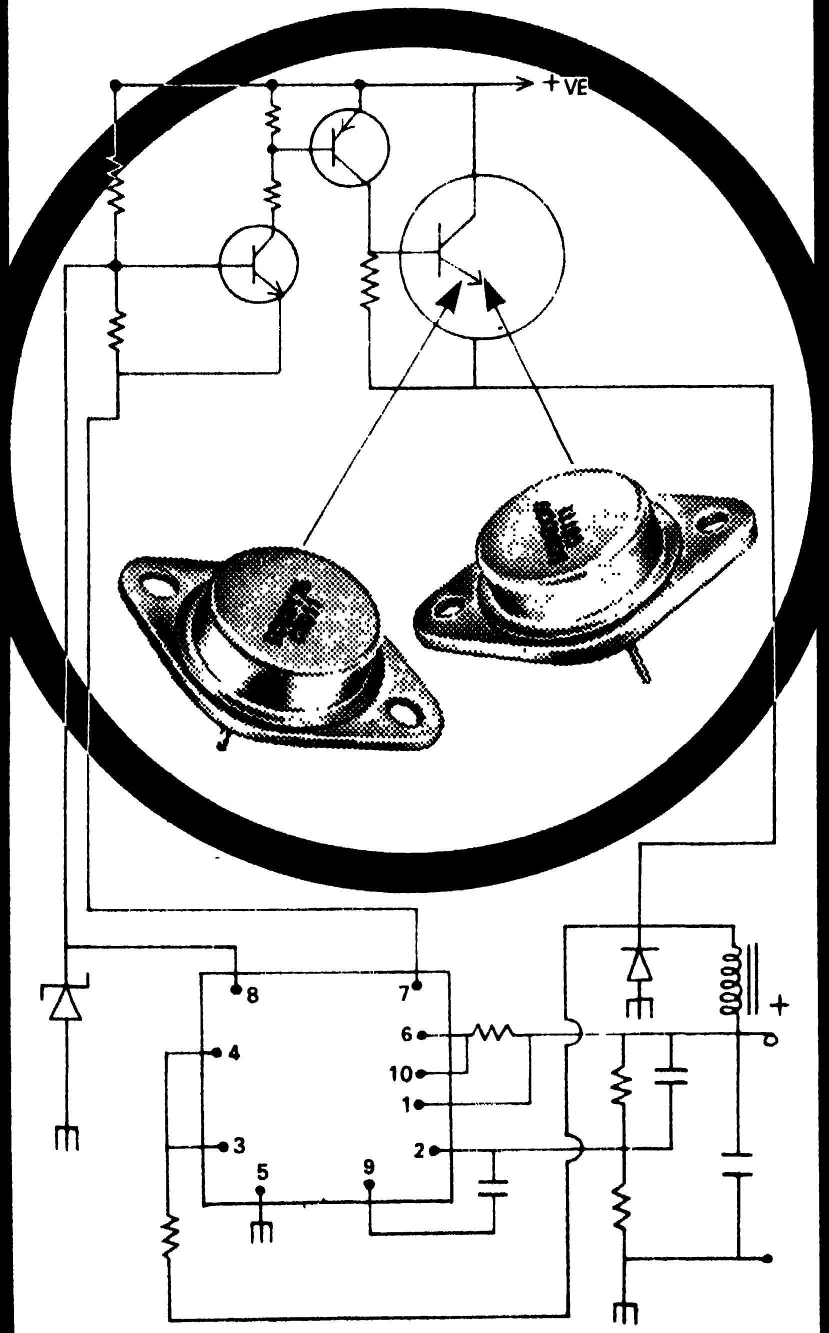

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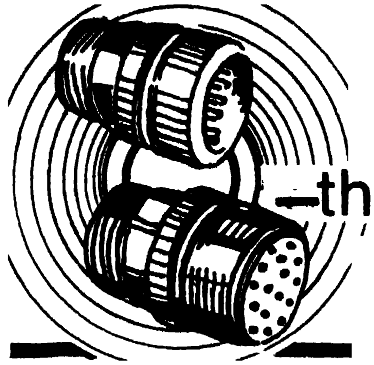

Circular Connectors —their Proper Usage and Reliability

George Olikara

The present-day trend of modular construction of electronic and electrical equipments has caused a rise in the use of a wide variety of connectors. The use of the circular connector , under which category fall a very wide range of connectors, from the simple audio connector used in domestic stereos to highly sophisticated umbilical connectors used in missiles and rockets, has increased the most.

The discussion here is restricted to two types of circular connectors which are most widely used in professional electronics in India. These are the MIL-C-5015G (JSS-50812) and MIL-C-26482 (JSS-50813) connectors.

Construction

A circular connector essentially has three components: (i) the contacts, (ii) the insulator, and (iii) the shell, as shown in Fig. 1.

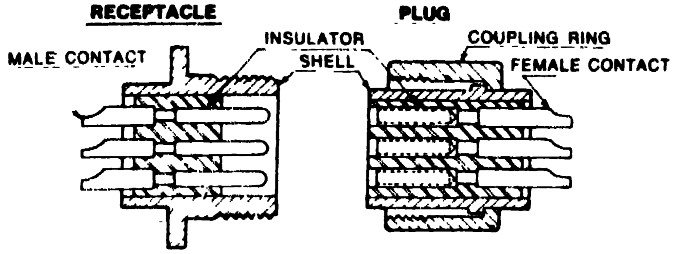

Fig 1

The contacts are the current conducting paths and are usually made of copper alloy. The insulator insulates the current conducting contacts from each other. It is made of various plastics or rubber. The main function of the shell is to protect the inside components from damage, and in certain cases act as a shield against electromagnetic radiation and radio frequency interference. The shells are made of either steel or aluminium alloy.

A connector has two mating halves. The half which is fixed on a panel is called a receptacle and the half which is fixed on the cable is called the plug. The exact design of these connectors (which is different for different manufacturers) is such that they meet the stringent specification of MIL-C-5015 (JSS 50812) or MIL-C-26482 (JSS 50813). These specifications cover such tests as climatic cycle, temperature cycling, vibration, impact, mating cycle, electrical parameters, fluid immersion etc.

As per MIL-C-5015 specification (JSS 50812) the connectors are specified by their shell size which is the outside diameter of the receptacle in multiples of 1.587 mm (1/16th of an inch). The commonly used shell sizes are: 8(12.70 mm dia.), 10(15.87 mm dia.), 12(19.05 mm dia.), 14(22.22 mm dia.), 16(25.40 mm dia.), 18(28.57 mm dia.), 20(31.75 mm dia.), 22(34.92 mm dia.), 24(38.10 mm dia.), 28(44.45 mm dia.), 32(50.80 mm dia.), and 36(57.15 mm dia.).

Under each shell size one can get different numbers of contacts arranged differently to get various working voltages and number of connections. Hence the user has a very wide choice of contact configurations to suit a particular circuitry. For example, Amphetronix Limited manufactures these connectors in technical collaboration with Bunker Ramo Corporation, USA in over 200 different configurations.

Proper usage

The basic requirement of the circular connector design is transmission of maximum electric power for the least possible connector weight while meeting all environmental requirements of the specification.

When the current flows through the contacts of the connector, there is generation of heat due to the I^2R losses. The heat generated raises the temperature of the connector. Both the specifications under reference allow the respective connectors to be operated up to a maximum temperature of 125°C (257°F) resulting from any combination of electrical load and ambient condition. Hence the amperage chosen per contact is such that the temperature rise of the connector is within the limit specified.

Conversely, for a given amperage the designer chooses the smallest diameter possible for the contact to keep down the weight of the connector. Hence one finds that a 16-gauge contact [0.0625-inch dia, (1.59mm dia.)] carries 22 amps, a 12-gauge contact [0.094-inch dia. (2.39mm dia.)] carries 41 amps etc, at the normal temperatures encountered.

One should therefore be careful while choosing a connector for an environment whose temperature is high—say about 75°C to 125°C. The specified amperage per contact

---

Mr Olikara did his graduation in mechanical engineering from the University of Mysore and postgraduation in production engineering, from the M.S. University of Baroda. At present he is working as manager (development), at Amphetronix Limited, Pune.

Table 1: Environmental Breakdown

Area	Shock	Vibration	Temperature	Contamination Sources
AFT body fairing (ABF)	3 5G Max	5 to 1000Hz 4 6 mm D A Max	-65°F to 175°F	Moisture, dust hydraulic oils
Air conditioning bay (ACB)	3 5G Max	5 to 1000Hz 4 6 mm D A Max	-65°F to 200°F	Moisture, dust, high velocity gases
Antenna cavity (AC)	3 5G Max	5 to 1000Hz 4 6 mm D A Max	65°F to 175°F	Moisture
Engines (E)	5 0G Max	5 to 1000Hz 3 8 mm D A Max	-65°F to 350°F	Moisture hydraulic oils jet fuel engine oil, hot high velocity gases
Mixing bay	3 5G Max	5 to 1000Hz 4 6 mm D A Max	65°F to 200°F	Moisture dust, high velocity gases
Nose (N)	3 5G Max	5 to 1000Hz 2 5 mm D A Max	-65°F to 175°F	Moisture
Nose wheel well (NWW)	3 5G Max	5 to 1000Hz 4 6 mm D A Max	65°F to 200°F	Moisture dirt hydraulic oil
Pressurised (P)	3 5G Max	5 to 1000Hz 4 6 mm D A Max	65°F to 175°F	Moisture dust
Tail (vertical horizontal tail surfaces) (T)	4 5G Max	5 to 1000Hz 10 2 mm D A Max	65°F to 200°F	Moisture
Wheel well (WHW)	4 0G Max	5 to 1000Hz 2 5 mm D A Max	-65°F to 200°F	Moisture, dirt, hydraulic & jet fuels
Wing (W)	5 5G Max	5 to 1000 Hz 10 2 mm D A Max	--65°F to 200°F	Moisture, dirt, hydraulic & jet fuels

should be derated such that the sum total of the environment temperature and the rise in temperature due to electrical loading is less than the specified temperature of 125°C. It is also important to keep in mind the extent to which a rise in temperature of the connector will be allowed in the place where it is fitted. For example, if a connector is to be disconnected with bare hands by an operator while the supply is on, the temperature of the connector must not rise above 50°C. In both the cases mentioned above one should either go in for a connector with larger diameter contacts or derate the contact amperage.

A third point which must be taken care of is the frequency of the power supply. Both the types of connectors under reference are designed for a DC supply or an AC supply of 50 to 60 Hz. If one uses these connectors for a power supply of 400 Hz to 1000 Hz frequency (which is nowadays used in certain applications), it would cause electric shocks due to arcing and would hurt the operator while he is unmating the connector with the supply 'on'.

The fourth point which should be given serious thought is the service life of the connector. As the temperature of operation increases, the service life of the connector decreases. The military specification requires that the connector should have minimum service life of 60 hours when operating at 125°C and 1000 hours when operating at 85°C. Even though actual connectors have much more service life than specified, one should give a thought to this aspect. The higher temperature increases the oxidation rate, specially of the insert material, causing deterioration of the electrical properties of the material.

Though the materials used in the connector are chosen carefully to stand hostile environments such as certain types of oils, chemicals, etc, one should be careful regarding the exact nature of the environment existing around the place where the connector has been fitted. For example, though the connectors are tested for immersion in fluids (as specified in JSS 50812 and JSS 50813) such as petroleum-based hydraulic fluids used in aircrafts, missiles, lubricating oil used in aircraft turbine engines etc, certain other types of oil cause a swelling of the rubber parts used in the connector. Similarly, highly alkaline or highly acidic atmosphere causes corrosion of the metallic shells. Even though the olive drab chromate coating provides a comparatively hard surface, care should be taken to avoid causing deep scratches, nicks etc during handling and installation. If these scratches expose the base metal, atmospheres saturated with salt mist would cause corrosion.

While selecting connectors, the skill of the assembly operators should always be considered. In the case of connectors with solder terminals, the insulation resistance of the insulating insert is very much reduced if the flux flows onto the insert surface. Similarly, if the excessive solder flows onto the outside of the contact, the effective gap between the contacts is reduced (especially if the solder forms into small globules with pointed sides), and this affects the limiting operating voltages. Crimp contacts are the solution to the above problems.

Table 2: MIL-C-5015 (JSS-50812)

Failure Mode	A			B				C			D				E
	AA	AB	AL	BC	BD	BE	BL	CF	CG	CL	DH	DI	DJ	DK	EL
ABF															
ACB															
ANT															
E		0/1		20	1					11	3	4		0/2	14
MB															
Nose		0/1													
NWW		0/15				1		2					0/1	0/2	1
P															
Tail				1		1				3					12
U															
WHW		0/6		4	1			5		9	10		0/2	0/2	9
Wing				4		1		3		3	1				
Total		0/23		29	2	3		10		26	14	4	0/3	0/6	36
Failure Mode Total Uncensored	23			34				36			27				36
Failure Mode Total Censored	0			34				36			18				36

Table 3: MIL-C-26482 (JSS-50813)

Failure Mode	A			B				C			D				E
	AA	AB	AL	BC	BD	BE	BL	CF	CG	CL	DH	DI	DJ	DK	EL
ABF															
ACB															
ANT															
E															
M B															
Nose															
NWW															
P		0/2		5							1				
Tail															
U															
WHW															
Wing															
Total		2		5							1				
Failure Mode Total Uncensored	2			5				0			1				0
Failure Mode Total Censored	0			5				0			1				0

CENSORED / UNCENSORED

Reliability

Every buyer is concerned about the reliability of the product he is buying. The concern is very deep if the item is to be used in an installation where failure can cause loss of human lives. Thus, while choosing connectors for use in aircrafts, ships, tanks, power generation units, medical equipments etc, reliability is a very important criterion.

The modern jet aircraft is the one installation where connectors are subjected to the most hostile environments. Hence a reliability study of the connectors under reference, if based on their use in jet aircraft, would cover most of the possible failure modes. The following discussion is based on such a study conducted by Bunker Ramo Corporation, USA.

The data has been compiled from the operations of several major airlines which use the Boeing 727 aircraft. The compilation covers the years 1964 and 1965, and the data encompasses some 525,000 in-flight hours accumulated by 209 aircrafts. This number of in-flight hours results in a total operating time of 88,809,660 hours for the two types of connectors under reference.

The environmental conditions experienced by the connectors are different for different parts of an aircraft. The conditions are almost completely benign in the area of the passenger cabin and are extremely severe in terms of pressure, temperature and contamination sources in some of the uninhabited portions of the aircraft. Table 1 gives a idea of these environmental differences.

In the source data, the primary failure was sought i each instance and it was found that the following failur modes could be identified and categorised.

Category A

Termination failures

A A —Defective termination (i.e. a failure occuring a the contact-wire joint by virtue of bad crimp, or a cold solder joint).

A B —Failure of the wire adjacent to the connector bu away from (to the wire side of) the point of wir contact joint.

A L —Specific point or circumstance of failure undetermined but within the generic failure mode.

Category B

Coupling failures

B C —Connector loosened

B D —Connector completely uncoupled

B E —Improperly mated connector (i.e. contacts bent, contacts cocked, contacts pushed back, connector misaligned).

B L —Specific point or circumstance of failure undetermined but within the generic failure mode.

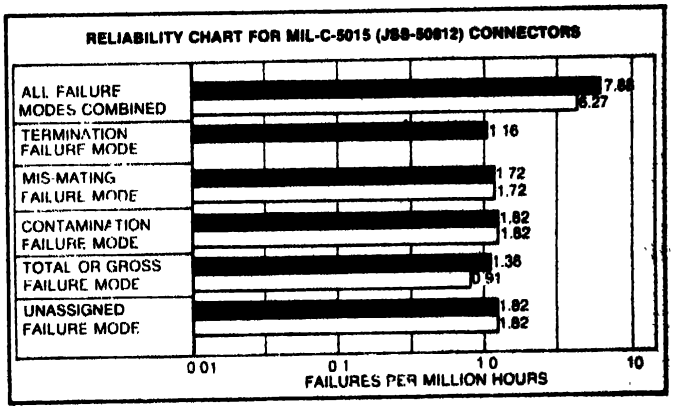
RELIABILITY CHART FOR MIL-C-5015 (JSS-50812) CONNECTORS

Fig 2

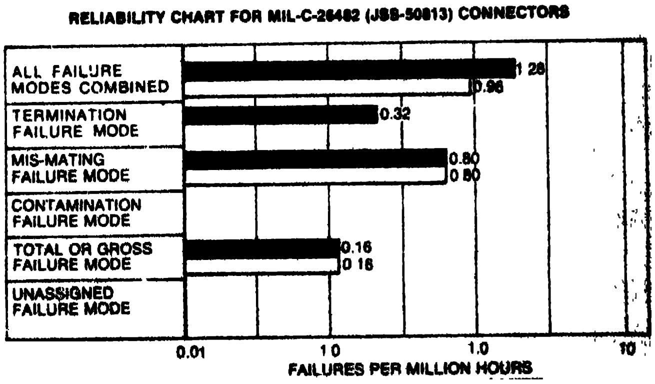
RELIABILITY CHART FOR MIL-C-26482 (JSS-50813) CONNECTORS

Fig. 3

Category C

Contamination failures

C F —Shorts or excessive leakage between contacts.
C G —Open circuits or high resistance due to dirty contacts.
C L —Specific point or circumstance of failure undetermined but within the generic failure mode.

Category D

Total or gross failures

D H —Connector damaged or broken
D I —Contacts damaged or broken
D J —Connector improperly assembled
D K —Connector improperly installed or wrong connector installed.

Category E

All other failures

E L —All failures which cannot be otherwise placed.

Earlier the total operating time for the two types of connectors under reference has been given as 88,809,660 hours. Even though the figure represents correct total connector operating time, the failure rates must be based on adjusted operating hours. This is because some airlines reported all connector failures while a few reported only those failures causing delays in departures. By comparing the failure rates based on data from airlines reporting all connector failures with those based on data received from airlines reporting only connector failures which cause delay, an adjustment factor of 3.41 to 1 is arrived at. Hence the adjusted hours are arrived at by dividing the actual hours by 3.41.

The failure rate is calculated as follows:

$$FR = \frac{\text{Number of connector failures}}{\text{Number of connector operating hours}}$$

In accordance with accepted reliability techniques, those failures which are not attributable to the device under study are *censored* and not used in computing failure rates. For example, a wire which breaks outside a connector would be censored and not counted as termination failure. Both the adjusted uncensored connector operating hours and the adjusted censored connector operating hours are used for calculating the failure rate and we get the adjusted uncensored failure rate and the adjusted censored failure rate.

Tables 2 and 3 give both total uncensored failures and total censored failures for the MIL-C-5015 and MIL-C-26482 connectors respectively

The total unadjusted and adjusted connector operating hours for both types of connectors are:

MIL-C-5015

Total unadjusted operating hours = 67,422,702 hours

Therefore total adjusted operating hours = 19,772,054 hours

MIL-C-26482

Total unadjusted operating hours = 21,386,958 hours

Therefore total adjusted operating hours = 6,271,835 hours

The failure rate of each type of connector can now be calculated under each mode of failure. For example, the failure rate for MIL-C-5015 under contamination failure mode can be calculated as follows:

$$\text{Adjusted uncensored failure rate} = \frac{36}{19772056} = 1.82 \times 10^{6}$$

The failure rates are calculated for each type of failure and all failure modes are combined and shown by means of bar charts as in Figs 2 and 3.

The MIL-C-5015 is the first generation of circular connectors designed for use in sophisticated military equipments. The original version of this connector type was released on July 27, 1949. The MIL-C-26482 is a second generation connector whose design is much better than that of the MIL-C-5015 connector, especially in its capability to seal the entry of contamination. This can be clearly made out from the reliability charts in Figs 2 and 3. It can be seen from the figures that in other aspects too, the MIL-C-26482 is superior to the MIL-C-5015 type connector and has a higher reliability rating.

The reliability values of each mode of failure are of use both to equipment designers and to other users of connectors, particularly because they can be improved if special care is taken of each failure mode. □

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FERROELECTRIC CERAMICS IN ELECTRONICS

R.S. Chimni

Ferroelectric ceramics are of considerable importance in the fields of electronics and allied branches of engineering. They are used in innumerable devices, mainly because they can be converted into rugged piezoelectric materials which can be produced in convenient shapes and sizes.

The desired electrical and mechanical properties can be obtained, within limits, by selecting a suitable mix of ingredients which go into the manufacture of a particular ceramic. They thus score over single crystal piezoelectrics. Certain applications also make use of the fact that the dielectric constant of the ceramics is dependent upon the applied electric field strength.

Their use in ceramic pick-up cartridges and piezoelectric gas lighters is well known. What is less known is the fact that they are used in such diverse fields as memory devices, milk emulsifiers and microphones. We find them in detonation fuses for missiles, delay lines for colour TV and radar, dispersers of pigment and in many other devices.

In order to understand these materials we may briefly touch upon the piezoelectric effect and shortcomings of piezoelectric elements made out of natural or artificial piezoelectric single crystals.

Piezoelectric effect

Piezoelectric effect was discovered by two brothers, Pierre Curie and Jacques Curie, in 1880 at Sorbonne. Piezoelectric effect is the appearance of equal and opposite charges on the surfaces of certain materials when mechanical force is applied on them in a particular direction. The quantity of charge that appears is proportional to the force applied. If the direction of the force is reversed, the sign of charges is also reversed. This is called direct piezoelectric effect.

The piezoelectrics display inverse effect also, i.e., they get deformed by the application of an electric field. The direction of deformation is also reversed if the direction of the applied field is reversed. The piezoelectrics therefore provide a convenient device for changing electric energy into mechanical energy and mechanical energy into electrical energy. (A device which converts one form of energy into another form is called a transducer.)

Piezoelectric properties of any matter are evaluated by piezoelectric constants. These are ratios of charge and mechanical force along an axis. The constant for quartz along piezoelectric axis is 2.2 pico Coulombs per Newton For rochelle salt it is about 1000 times larger.

Piezoelectric crystals

The Curie brothers discovered piezoelectric effect in certain crystals like quartz, tourmaline and rochelle salt Many more crystals, including crystals of sugar, were found to have piezoelectric properties in subsequent years. For the next 65 years, i.e., up to about 1945 all the piezoelectric devices were based on plates, rods, rings etc cut out of crystals such as rochelle salt, ADP (ammonium dihydrogen phosphate), quartz etc.

Piezoelectric and physical properties of elements cut out of crystals are determined by the properties of the crystals This imposes restrictions on the shape and size of the piezoelectric elements (plates, rods etc) which have to be cut in a particular manner due to the fact that the direction of various axes cannot be altered in a crystal generally.

The range of temperature and humidity within which some of the crystal materials can be used is very limited For example, rochelle salt cannot be used above 45°C and relative humidity has to be within 40 per cent and 70 per cent if the crystal plate is unprotected. ADP can be used up to 125°C and lithium sulphate up to 75°C.

Some of the problems and limitations of single crystal material have been overcome with the developmnt of ferroelectric ceramics. (Ceramic is generally defined as a product obtained through the action of fire upon an earthy material. The word 'ceramic' is from the Greek word 'keramos' meaning 'pottery' and is probably related to the older Sanskrit root meaning 'to burn')

It may be pointed out here that single crystal quartz is still the best material for purposes of frequency control and precision accelerometers.

Ferroelectrics

Ferroelectrics are dielectric analogues of ferromagnetics (iron, steel etc). They have spontaneously polarised domains (microscopic regions) and show hysteresis when a varying electric field is applied (like B-H curve of ferromagnetics). The polarised domains can be aligned by an external electric field.

Like ferromagnetic materials, they have an upper temperature, known as ferroelectric Curie temperature beyond which they cease to be ferroelectric. (Rochelle salt has an upper, + 24°C, and a lower, -18°C, Curie temperature) Their dielectric constant depends upon the applied electric field if saturation does not take place.

Ferroelectric properties were noticed in 1921 for the firs

Mr Chimni, 51, is working at Controllerate of Inspection (Systems), Secunderabad as principal scientific officer since 1973. In all, he has spent nearly 30 years in the electronics field under the Ministry of Defence, mostly at CIL, Bangalore.

time, and up to the middle of forties all ferroelectrics known were single crystals such as rochelle salt, barium titanate and potassium dihydrogen phosphate.

Barium titanate ferroelectric ceramics

In 1942 barium titanate was found to have certain special properties as a dielectric. These were investigated and it was found to be ferroelectric. This in itself was not of much engineering importance. It was found later that barium titanate displays ferroelectric properties in multicrystalline form, i.e. it is ferroelectric in ceramic form with Curie temperature of 120°C.

The ceramic form of barium titanate, it was found, can be converted into piezoelectric material by heating it beyond 120°C and allowing it to cool in the presence of a constant electric field. On cooling, the material is converted into piezoelectric material with polarisation in the direction of the applied field. After removal of the field the material retains about 80per cent of its initial piezoelectric response

Barium titanate ceramics are resistant to heat and humidity and have high mechanical strength and are therefore more useful in certain applications than some of the single crystals.

Improvements in ceramic ferroelectrics

Subsequent to the discovery of the useful properties of barium titanate ceramics, a number of substances with related crystal structure were found to have similar properties. Some of them are zinc, strontium and cadmium titanates, lead zirconate, several niobates, tantalates etc.

Ferroelectric ceramics have been made based on the above-mentioned and other similar materials. By having a suitable mix of some of the above-mentioned and other similar materials and additives, ferroelectric ceramics having properties required for various applications can be obtained. For example, Curie temperature can be raised by addition of lead titanate and it can be lowered by addition of strontium compounds.

Due to forces acting between crystals the electrical polarisation of the ceramics is more stable than that of a single crystal. In this way it has been possible to produce ceramics comparable with rochelle salt in sensitivity and with quartz in chemical stability.

The table below gives dielectric constants and Curie temperature of a few ferroelectric ceramics.

Material	*Dielectric constant*	*Curie temperature*
1. Ba Ti 0_3 (Barium Titanate)	1500	120°C
2. Ba Ti 0_3—80% + Pb Ti 0_3—20% (Barium Titanate + Lead Titanate)	1500	350°C
3. Pb Nb 0 - 80%+Ba Nb 0_3 — 20% (Lead niobate+ Barium niobate)	400	425°C
4. Pb Nb 0_3 — 60%+Sr Nb 0_3 — 40% (Lead niobate+Strontium niobate)	755	310°C

It will be seen from the table that a wide range of Curie temperatures and dielectric constants can be obtained. In the same way, desired physical and mechanical properties can be obtained for low stress and high stress applications. Elements can be made in the form of bows, tubes, plates, disks, or a multitude of elements can be set in any suitable arrangement. By suitably shaping the ceramics it is possible to concentrate and focus energy generated in the work area.

The most widely used ferroelectric ceramics are solid solutions of lead zirconate and lead titanate with various additives and varying proportions of the two main ingredients. These materials have a piezoelectric coefficient around 10^{-10} Coulomb per Newton. They are commonly known as lead zirconate titanate and marketed as PZT with distinguishing digits by Clevite Corporation of USA and as PXE by Mullard in UK.

Methods of manufacture

As stated above, the properties of the ceramics depend upon the ingredients which go into their manufacture. Depending upon the properties desired, the ingredients are selected, carefully weighed and mixed in the required proportions. The powders are thoroughly mixed and heated for a long time. The matter so obtained is repowdered and a binder is added. The powder is compressed into the desired shapes and is fired in a kiln under strictly controlled conditions. The elements so obtained are cleaned and electrodes are plated on them. The final step is to impart piezoelectric properties to the elements by subjecting them to an electric field. The elements are polarised so that opposite faces have opposite charges, and a piezoelectric axis is formed between the electrodes.

Applications of ferroelectric materials

The application of ferroelectric materials can be divided into two types. One type of application makes use of piezoelectric properties while the other type makes use of the fact that ferroelectrics are non-linear dielectrics, i.e. dielectric constant varies with the applied voltage.

The applications making use of piezoelectric properties can be divided, for ease of discussion, into the following categories:

(a) Applications in audio engineering
(b) Applications under water
(c) Applications in industry
(d) Miscellaneous applications.

It should be remembered that all the above-mentioned applications are based on the fact that the piezoelectric element is capable of converting mechanical vibrations into electrical oscillations and vice versa up to frequencies in the range of several megahertz.

Applications in audio engineering

The main use of ceramics in audio engineering is in the manufacture of phonograph pick-up cartridges and ceramic microphones. In case of ceramic pick-up, the stylus usually bends the ceramic element and thus produces voltage proportional to the force applied to the element. Ceramic pick-ups are not affected by humidity and heat as is the case with pick ups using rochelle salt. The ceramic material used is usually barium titanate or lead zirconate. An output of about 500 mV can be easily obtained.

Ceramic microphones make use of lead zirconate titanate element. They are not very popular due to certain shortcomings such as a very high impedance and are not suitable for use with long cables unless a preamplifier is provided.

Underwater application

Ceramic elements are used extensively in hydrophones, sonar and underwater transponders as they are particularly suitable for producing and detecting acoustic waves in water. Piezoelectric solids are much better matched acoustically to water than to air. Barium titanate and lead zirconate titanate are often used for underwater applications.

Uses in industry

Ferroelectric ceramic elements are used in pigment dispersers, ultrasonic cleaners, certain tools, soldering irons, flaw detectors, thickness gauges etc. In case of flaw detectors, short pulses of ultrasonic waves are applied to the material under test. The waves are reflected from flaws within the material. Flaws are detected by observing the reflected waves.

Miscellaneous applications.

There are many other applications such as filters, accelerometers and delay lines used in colour TV, in moving target indicator, artificial permanent echo generator for radar monitoring etc.

In case of delay lines, the electrical waves are converted into acoustic waves and made to travel a short distance before they are again converted into electrical waves. This is achieved by the use of ceramics. Since acoustic waves travel at much less velocity, delay in transmission is achieved.

Applications as non-linear devices

The ferroelectric ceramics find use as non-linear dielectrics. They are used in memory devices making use of the fact that by application of suitable electric field the direction of polarisation can be reversed. The ceramics can be used in dielectric amplifiers, non-linear capacitors with controllable capacitance, frequency multipliers etc.

Future

With advances in science, particularly in solidstate physics, it is expected that new ceramic materials will be made. The presently known materials will be improved and put to new uses. Ferroelectric ceramics have come a long way in only three decades. They have a vast potential yet to be tapped. □

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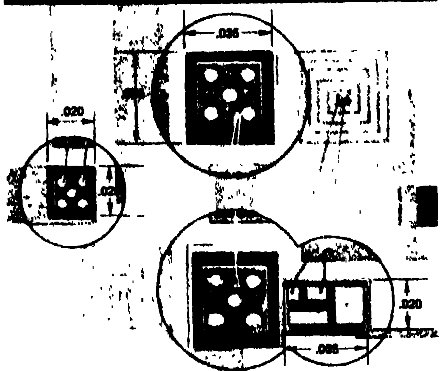

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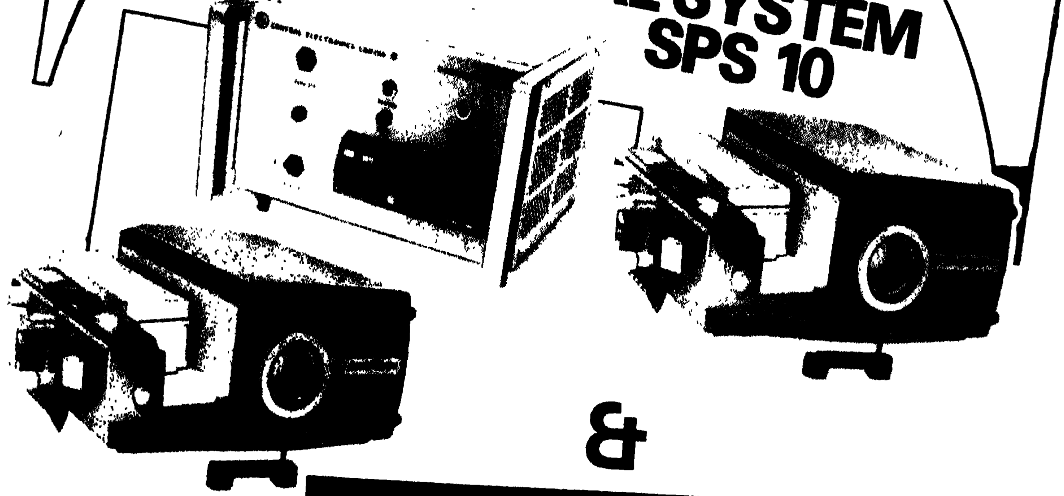

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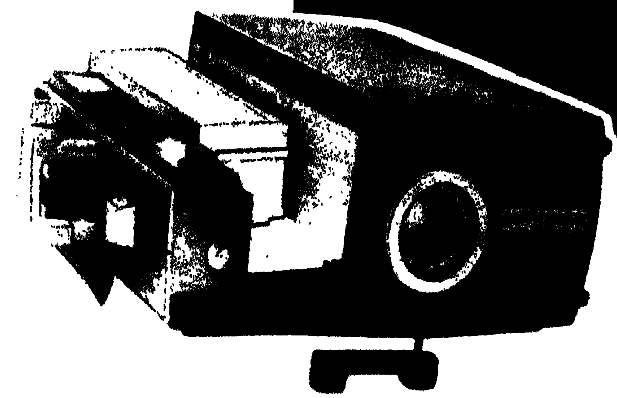

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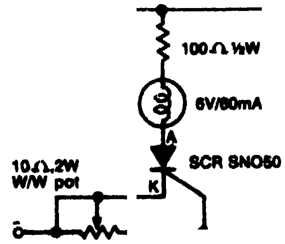
CIRCUIT IDEAS

Short-circuit/Overload Indicator

This indicator is a simple but efficient way of indicating and protecting a power supply from short-circuit or overload conditions. The circuit can be incorporated in a power supply inbetween unregulated DC and regulation circuit, or at the output.

The working principle of the circuit is very simple. Normally the SCR will be in off condition. So there is no current flow through SCR,and the bulb won't glow. When you exceed the limited load current, the voltage developed across the cathode and gate of the SCR is sufficient to switch it on. So current flows through the bulb and it glows, indicating the overload/short-circuit condition.

The potentiometer is for limiting the current. You can fix the pot and the bulb in the front panel of the power supply so that you can set the potentiometer to the required current limit. Use a suitable heatsink for the SCR.



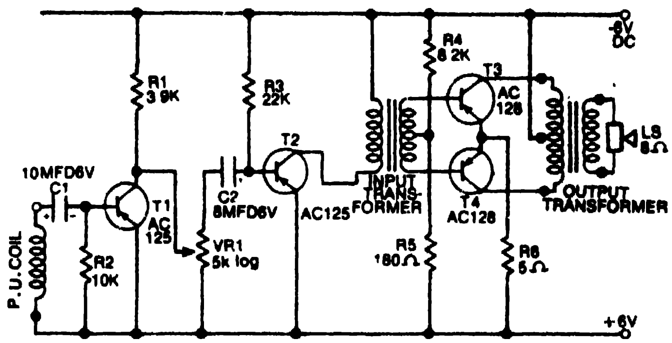
With SNO50 this circuit can be used up to 30V and with SNO51 it can be used up to 100V. In the latter case the series resistor value has to be changed according to the DC voltage. With 10-ohm, 2W wirewound potentiometer, this circuit can be used for a maximum load current of 1A. The circuit should not cost more than Rs 25.

L. JAMBU

Low-cost Telephone Amplifier

This circuit for a solidstate telephone amplifier requires four semiconductor devices and a few other components only to give a satisfactory result. The total cost of the amplifier is around Rs 40.

The pick-up coil is an important part of this telephone amplifier. You can get this coil made to order from any coil winding shop, or you can wind it yourself as follows. Wind 3000 turns of 40SWG copper enamelled wire over a 4cm dia plastic tube. When the winding is complete, bind the coil with a self-adhesive tape. The enamel must be scraped off the wire at the ends of the coil. When this is done, a shielded wire of about a meter length may be connected to the ends of the coil.



Wiring is not critical, and the entire unit can be constructed on a small piece of PCB or groupboard. Potentiometer and switch should be mounted on the top or front panel of a suitable enclosure and not on the PCB. Proper aluminium heatsink must be provided for the output transistors. The circuit may be powered by a 6V battery or any other 6V DC source.

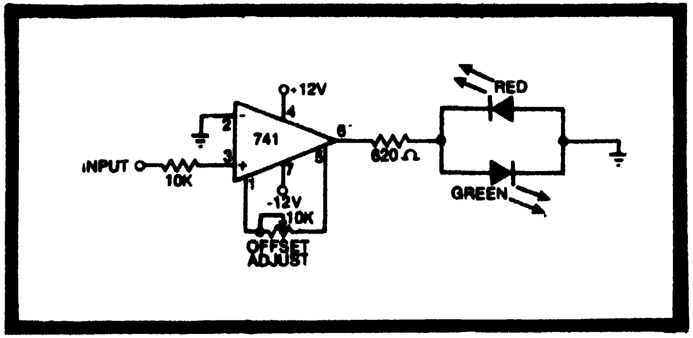
For testing the circuit after assembly, first check the connections properly. Keep the 5k log potentiometer in its rest position and switch on the device. Remove the handset of the telephone from its rest position and keep it aside. Keep the pick-up coil close to the telephone. You will hear the dial tone coming from the speaker. Now move the coil so as to get the maximum loudness of the dial tone. Attach the coil in that position to the telephone by a self-adhesive tape.

Now the amplifier is ready for use. Dial a number and you will hear the conversation of both the sides loud and clear from the speaker. While talking on telephone, keep the potentiometer at the minimum position, and keep the mouth piece of the handset away from the speaker; otherwise self-oscillation will occur.

PRADEEP KUMAR SAHU

Polarity or Null Indicator

Input is applied to non-inverting input (+) terminal of the operational amplifier. Output is positive when the input is positive and thus the green LED lights up. When the input is negative, the output of the operational amplifier is also negative and the red LED lights up.



The operational amplifier has been used to increase the sensitivity and to achieve a very low input voltage threshold, which is ±6mV or less for a 741 operational amplifier. No loading was observed and the input current was very small.

The circuit can be used as a sensitive polarity indicator or a null indicator.

V.K.KOHLI

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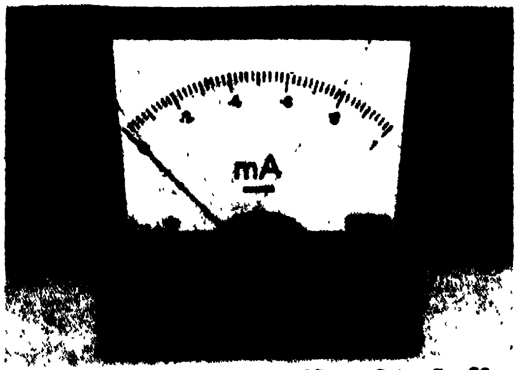

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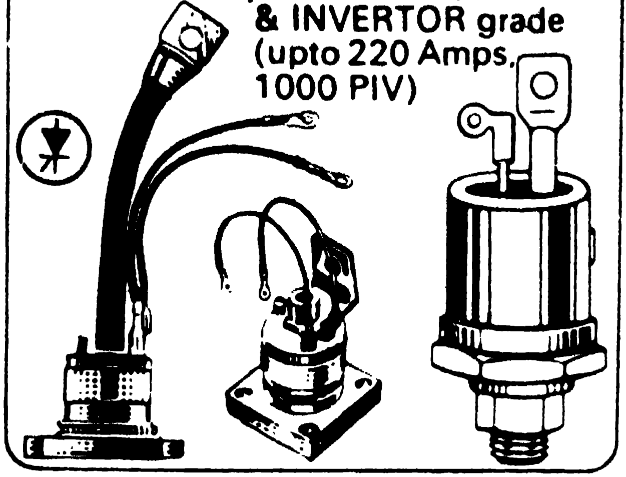

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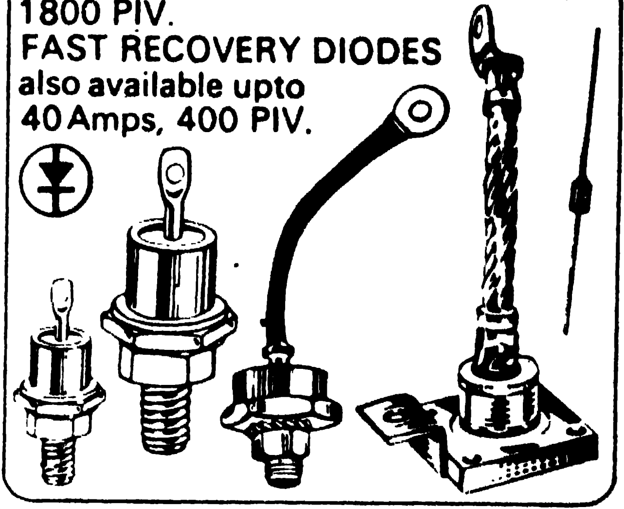

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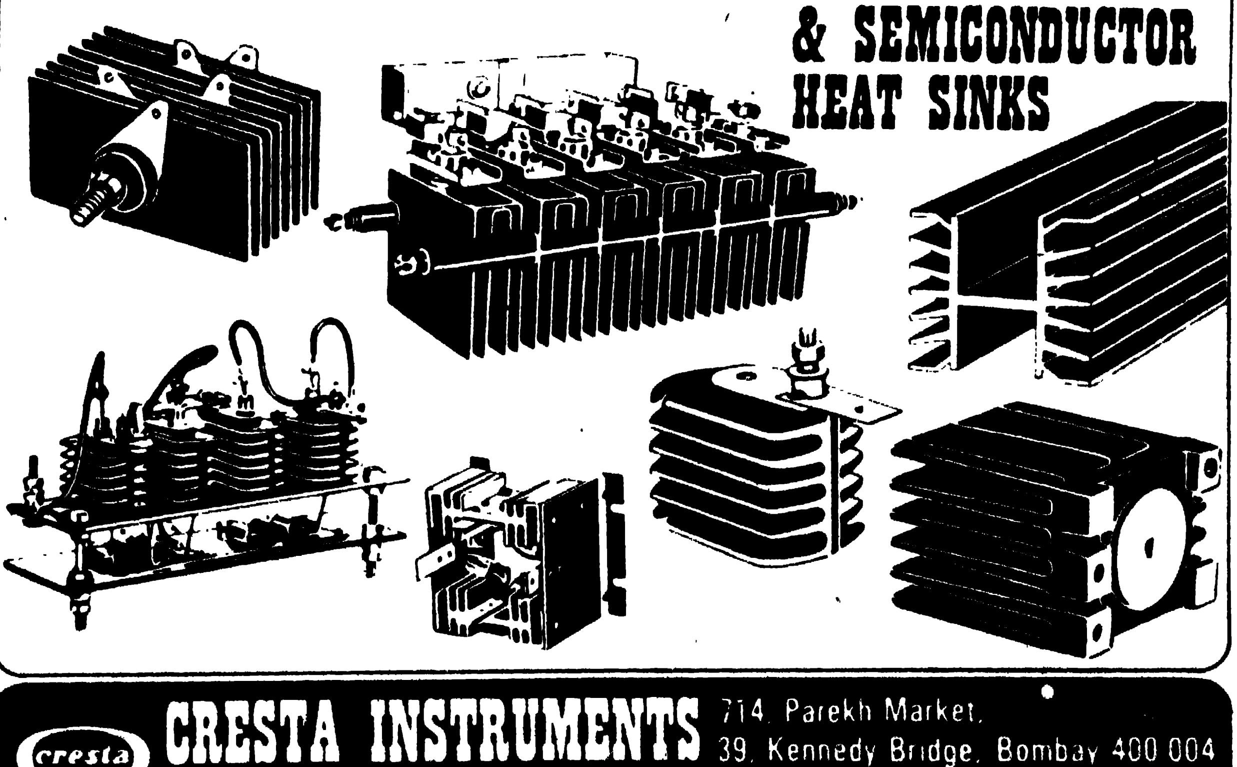

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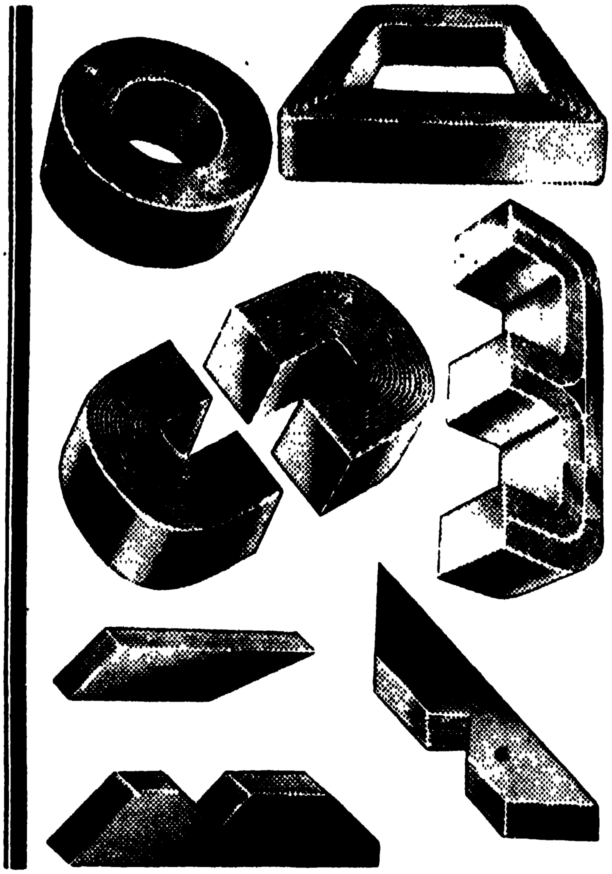

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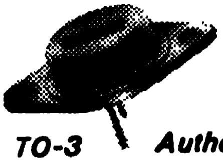
2N6264	150	4	50		—
2N6253	45	15	115	6	1.8
2N3055	60	15	115	typ	max
2N6254	80	15	150	@	@
2N4347	120	15	100	1.0	6.0
2N3442	140	15	117		
2N6262	150	15	150		
2N3771	40	30	150	10	1.8
2N3772	60	30	150	typ	max.
2N6258	80	30	250	@	@
2N4348	120	30	120	1.0	10.0
2N3773	140	30	150		
2N6259	150	30	250		

TO-66

* For Linear applications (amplifiers and regulators) general purpose Low Frequency (Single Diffused) Transistors in TO-66 and TO-3 offer the most "Watts per rupee" value. Excellent SOA makes these types idea for inductive loads such as DC Motor controls or 40 to 400 Hz inverters.

** High Frequency (Epitaxial Base) Transistors in TO-3 with very low tOFF, are also available and are recommended for use in high speed inverters, switching regulators, AC motor drives, etc., upto 30 KHz.

When ordering these, put F at end of above device type Numbers, as in 2N6259 F.



TO-3

Authorised Stockists :

Bangalore : *Texonic Instruments, Tel : 77510*
Bombay : *Lalwani Electronics,*
Tel : 352403 / 380946
Ramesh Trading Corp., Tel : 351624
Parekh Enterprises, Tel : 366423
Calcutta : *General Radio Co. Tel : 231357/237229*
Delhi : *Electronic Components, Tel : 277747*
Jaipur : *El-tronics, Tel : 65730*
Madras : *Texonic Instruments,*
Tel 844405 / 844112
Poona : *International Electronics,*
Tel 27054 / 22977

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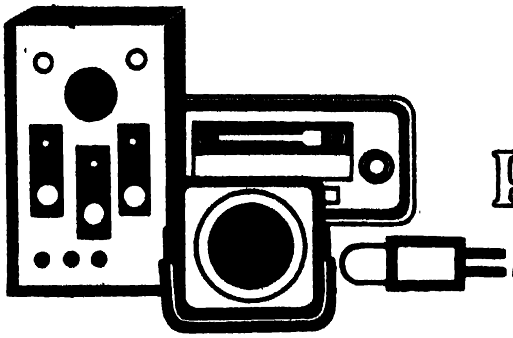
SOLID STATE ELECTRONICS CO. PVT. LTD.
PLOT NO. 9/123 M.C.I.E., SIR M. V. ROAD, P.O. BOX NO. 7432,
J. B. NAGAR POST, BOMBAY-400 059.
TELEPHONE: 58 52 40 CABLE: ALLDIFFUSE



PRODUCT PROFILES

COUNTERS

Use of CMOS LSI circuitry and a one-chip microprocessor has cut the cost of two new frequency counters from Philips Test and Measuring Instruments. The 120MHz PM 6667 and 1 GHz PM 6668 provide high resolution, 15mV sensitivity and auto triggering on all waveforms.

A choice of two measuring times is provided—either normal with 7-digit resolution every second or fast mode with 6-digit resolution every 200 ms. Display is on a clear high-contrast liquid crystal display.

The counters are packed in rugged, high temperature and impact resistance polyphenylenoxide cases with full screening against electromagnetic interference. The instruments run on 115 or 230V AC ± 15% at 50 to 60 Hz or from an optional internal battery pack providing for up to five hours continuous use.

Contact: Peico Electronics & Electricals Limited, S&I Department, Shivsagar Estate, Block 'A', Worli, Bombay 400018.

SMOBC PTH BOARDS

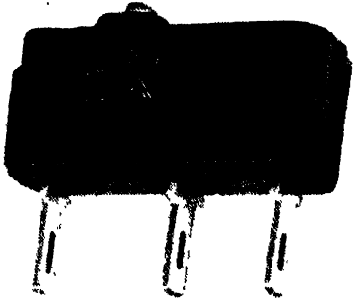
Hegde & Golay offer for the first time in India SMOBC PTH boards, especially for fine line applications where wave-soldering damages solder resist coated over fused tin alloys, resulting in impairment of protective properties of solder mask as also in poor cosmetic appearance. Solder mask is coated on bare copper and only terminal pads are selective tin-alloy coated by patented processes for selective deposition.

Flexi-rigid boards which have also been made successfully by Hegde & Golay by combining flexible circuits and multilayer technology, enable a wide variety of critical packaging challenges to be met successfully.

Contact: Hegde & Golay, Shreeshyla, Kanakapura Road, Bangalore 560062.

SUB-MINIATURE MICRO SWITCH

IEC has recently introduced type MS-4 sub-miniature micro switch,, especially designed for electronic and space applications where size and weight are critical parameters. This micro switch has a precision snap-action mechanism for micro-sensitive operations.



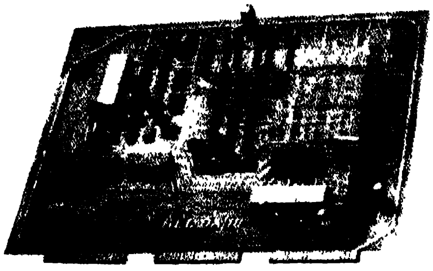
The switch is available with different terminals and actuators to suit different requirements of the industry.

Contact: Indian Engineering Co., P. O. Box 16551, Worli Naka, Bombay 400018.

BOARD LEVEL CONTROL PROCESSOR

Industrial Electronics is introducing a versatile and economical microprocessor-based control processor which includes CPU, System clock, RAMs, I/O lines, Serial communication interface and Bus logic drivers on a 26.6cm by 21.6cm PCB.

Its present system includes 1.5 byte of monitor program for Hindustan Teleprinter commands. It also contains 256 bytes of RAM and 24 I/O lines, expandable to a maximum of 3k ROM, 1k RAM and 48 I/O lines. All data address and control signals are brought out on three 44-pin connectors so that the capabilities of the system can be expanded by additional memory boards to a total of 65k bytes (ROM + RAM).



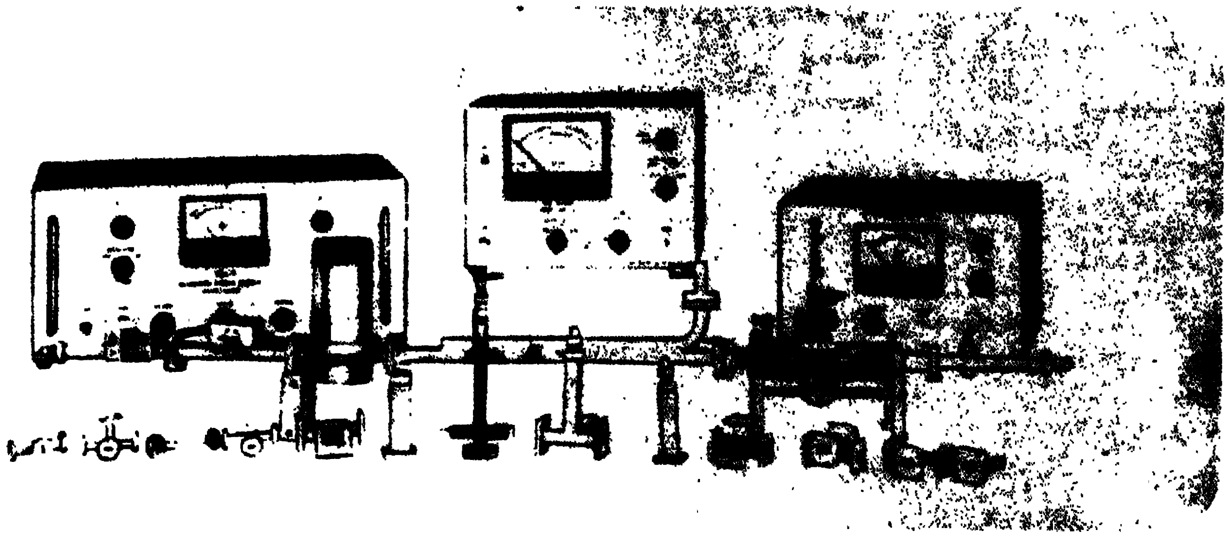
This control processor is based around National's 8-bit microprocessor SC/MP II, which is simple to use and cost effective also. RS232C and teletypewriter interfaces are included on the board and can be selected by means of programmable jumpers.

BLC 8A/10 can function as complete CPU in the end use control applications, and also serve as a complete development system for the user. The I/O structure has been carefully designed so that the board directly interfaces with a DPM, tachogenerator, pH meter, temperature indicator, etc.

Contact: Industrial Electronics, 202 Parvati Industrial Estate, New Sun Mill Compound, Lower Parel, Bombay 400013.

SICO MICROWAVE EQUIPMENT

Manufactured under Technical Collaboration of NATIONAL PHYSICAL LABORATORY OF INDIA



The Scientific Instrument Co. Ltd., manufactures a wide range of Microwave waveguide components and associated instruments for Educational and Training Institutions, Research Organisation, Defence Establishments, Communication and Industry. All our products are subjected to a systematic Quality Assurance Programme which embraces the entire manufacturing cycle from initial design studies through the development motion type production and full production. For final certification of our components are tested at National Physical Laboratory, New Delhi. In-house design and development facilities and a continuous urge to improve the products is a guarantee that you get the best value for your money.

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ROTARY WAFER SWITCHES

Overall Diameter, mm.	17 5	27.0	40.0	40.0	46.4
Insulation	Diallyl Phthalate	Diallyl Phthalate	Phenolic	Ceramic	Diallyl Phthalate
Design Classification J.S.S. 51207 MIL-S-3786	 SRW01 SR 19	 SRW02 SR 05	 SRW06 SR 02	 SRW06 SR 02	 SRW05 SR 32
Contact rating at 28 VDC resistive	0.25A	1.0A	2.0A	2.0A	1.0A
Maximum number of positions x angle of throw	12x30°	4x90° 6x60° 8x45° 10x36° 12x30°	4x90° 6x60° 8x45° 12x30°	4x90° 6x60° 8x45° 12x30°	12x30 14x25.7°* 16x22.5° 18x20° 20x18°* 24x15° 28x12.85° 32x11.25 36x10°

* AVAILABLE WITH LONGER LEAD TIMES

CONTACT CONFIGURATIONS:

Almost any combination of circuitry is possible by suitably positioning contacts. Multiple wafers can be used as required. (In the case of the HM the maximum number of wafers is 5)

Shorting (Make before Break) or Non-Shorting (Break before Make) contacts can be supplied.

CONTACT MATERIALS:

Silver alloy contacts with or without Gold plating or flashing and Brass contacts with Silver plating are available. Contact life, rating, resistance and other application conditions determine the type of contacts to be used.

OPTIONS AVAILABLE.

Military versions Water Sealing, Electromagnetic Shields Brackets, Printed Circuit Clips, Lugs, Special Clips (flat, reverse, etc) Dual-Concentric shaft/Dual Concentric switch assemblies, etc

The AM switch is available in the Lever operated configuration also

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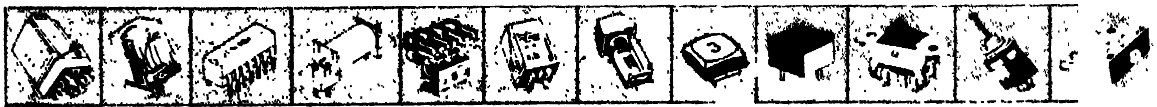

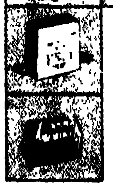

*
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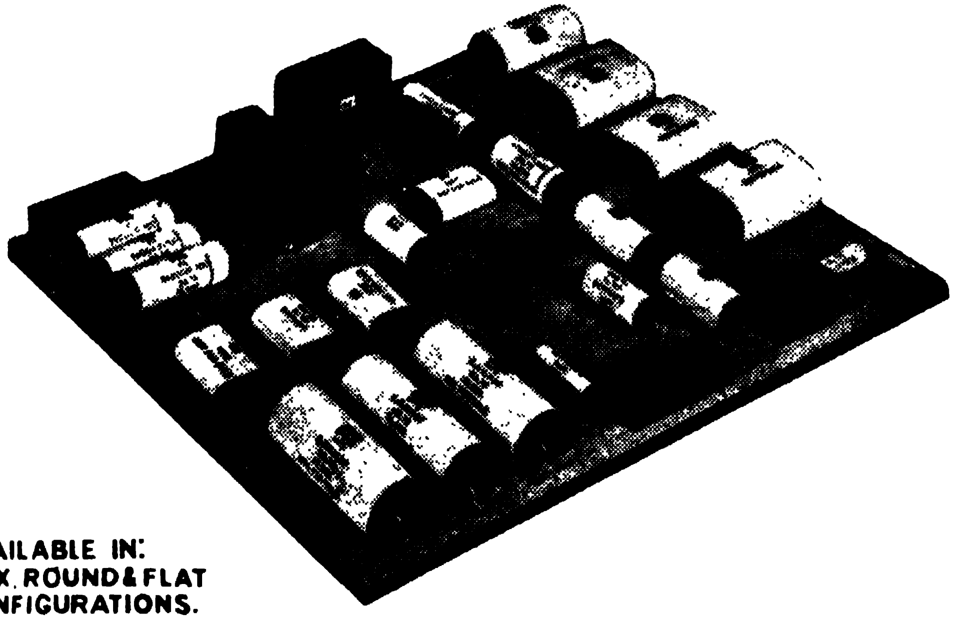

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Oh, what a difference diamonds can make to your ears!

You are looking at a 0.5 mil. spherical diamond stylus that is housed in a stereo magnetic cartridge

And both these are integrated with HMV's new precision, low mass tubular pick-up arm that tracks your records effortlessly Providing true hi-fi stereo sound

There's a lot to be said about HMV's attention and care to sound reproduction detail Most stereo makers give you a sapphire stylus tip. If you want a diamond stylus, you pay extra With HMV, you don't, for the diamond stylus tip. Next comes the stereo magnetic cartridge. Most others will fit a ceramic cartridge. And ask you to pay anything over Rs 200/- more for a magnetic cartridge.

But HMV is generous when it comes to sound reproduction quality.

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First, the stylus tip that's cut and shaped from diamonds to last longer, and track better over the microgrooves of your records.

And secondly, the magnetic cartridge is far more sensitive and is capable of tracking at very low stylus pressure It also has a wide frequency range stereo response that guarantees hi-fi sound reproduction

In addition, the magnetic cartridge with its high compliance stylus movement and low tracking weight plays your valuable records with minimum wear and tear. What's more, it also has an easy-to-handle hydraulic cueing device.

Ask for a demonstration of Stereo 3131 Supertrack 60 watts stereo system from your nearest HMV stereo dealer.

Today, HMV's superiority in electronic sound systems is proved by over 650,000 happy customers all over the country.

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- Disc Packs
- Diskettes

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COMPANY PROFILES

ECIL Sells First Disk-based Computer

Electronics Corporation of India Ltd's first disk-based commercial data processing computer system TDC-312D will be installed at Colour Chem, Bombay.

The TDC-312D is built around an improved version of TDC-312 CPU with memory extension control and extended arithmetic unit options.

The computer system consists of a 32,000-word semiconductor memory, a card reader (600 cards per minute), a line printer (600 lines per minute), and a disk cartridge capable of 13 million bits storage capacity made up of 6.5 million fixed storage and 6.5 million removable storage. The CRT terminal is provided as a console device.

Colour Chem will be using this versatile TDC-312D to computerise its financial accounting, inventory control, MIS and payroll.

Uptron Anand to Begin Production

Uptron Anand, a venture jointly promoted by Anand Electronics and UP Electronics Corporation for the manufacture of TV picture tubes, will begin commercial production by February 1980. With plans to manufacture 40,000 TV picture tubes per annum, the company expects to start trial production in December this year.

The estimated project outlay of Rs 8.1 million will be met through an equity capital of Rs 2.8 million, preference shares of Rs 190,000 and term loans of Rs 5.11 million.

The main plant for the venture is being supplied by the General Engineering Co. (Redcliffe), UK. The major part of the machinery will be imported from the UK and USA. The major portion of raw materials and components will also be imported, involving foreign exchange expenditure of Rs 8.5 million per annum.

Technical consultancy will be provided by the Bhabha Atomic Research Centre.

HCL's Proposed Tie-up with Singapore

Hindustan Computers Limited, a joint sector undertaking, has been invited by the Singapore government to take up manufacture of computers in that country.

This was announced by Mr S.S. Nadar, managing director of HCL, at the inauguration of the company's area office at Coimbatore.

According to Mr Nadar, computers manufactured in Singapore will cater for the markets in Malaysia, the Phillippines, Thailand, Indonesia and the Middle East countries.

Konark TV: Plans to Diversify

The bleak conditions in the TV market have compelled Konark Television of the Orissa government-owned Small Industries Corporation to go in for production of radio sets.

In spite of earning a net profit of over Rs 1 million in 1978–79, Konark TV is facing difficulties in selling its TVs this year. Only the demand for one of the TV brands manufactured by it, Bhaskara, is exceeding supply. The sales of all its other brands have been falling steadily.

This situation is the result of a general slump in the TV market, caused by a sharp escalation in excise on TV sets, and a delay in setting up telecasting stations at important centres like Bangalore and Ahmedabad.

Konark plans to initially produce low-priced, two-band radio sets to be sold under the already popular Konark brand name. Production will start in February.

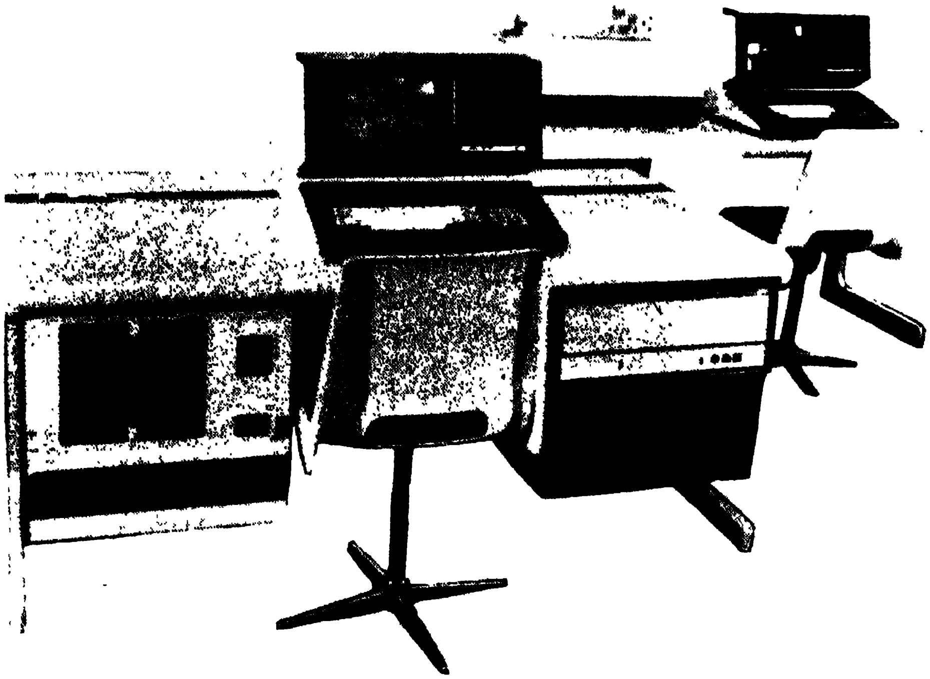
GCEL Develops Radio Equipment

Gujarat Communications and Electronics Ltd, a Gujarat government undertaking, has made a major breakthrough in the country's communication development programme by developing a point-to-point radio relay communication equipment which is undergoing testing at the firm's R & D division.

Though the equipment is still under test, GCEL has secured firm orders for 24 terminals at a cost of about Rs 4.2 million against stiff competition from long-established companies in the country. GCEL's radio equipment can handle more than 200 channels at a time.

The five-year requirement of this equipment is approximately Rs 1000 million. The present production capacity available in the country is about Rs 600 million. GCEL expects to somewhat fill the gap of Rs 400 million when it reaches its target of Rs 120 million of annual production in 1982–83.

Small Business Computer
VIDEOTON VT 60



VIDEOTON VT 60 combines man's cleverness and computer's quickness. VT 60 equipped with a software for wide range of applications is an up-to-date data processing system dedicated for time-sharing applications, data communication networks, real-time data base management, transaction processing. The CPU is microprogrammed (16 bit) on a single PC board. The CPU with 128 KB storage capacity is connected to the BUS, the data transfer of which is 2.3 MB/s and can handle 14 microprocessor controlled peripheral interfaces.

The Hungarian VIDEOTON offers you richer variety of basic software than other hardware producers. Parallel with FORTRAN IV, COBOL, RPG II and PROCOL high-level program languages you get a MACROASSEMBLER and the DMS 60 data base management and transaction processing system as well

VIDEOTON

INDUSTRIAL FOREIGN
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HUNGARY

Budapest 62 P. O. B. 557

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TELEX: 22-4783

Licences and Letters of Intent

The following licences and letters of intent have been issued to electronics firms under the Industries (Development and Regulation) Act, 1951 during the month of August 1979.

Name & address of the applicant and location of the undertaking	*Date & type of licence*	*Article*	*Quantity per annum*
LICENCES			
Orient Vision Ltd 113, Mount Road, Madras 600002 (Hosur, T.N.)	7.8.79 (NU)	TV receivers	100,000 pieces
R. Bhandari 29 Community Centre, 2nd Floor, East of Kailash, New Delhi 110024 (Gurgaon-Haryana)	8.8.79 (NU)	Industrial relays	500,000 nos.
Central Electronics Ltd 4 Industrial Area, Sahibabad 201005 (U.P) (Distt Meerut-U.P.)	31.8.79 (NU)	Liquid crystal displays	500,000 nos.
LETTERS OF INTENT			
Gujarat Communication & Electronics Ltd Express Building, R.C. Dutt Road Baroda 390005. (Baroda-Gujarat)	22.8.79 (NA)	Extended range VHF communication system	5 systems
Hindustan Conductors Pvt Ltd 24 Sayed Abdulla Brelvi Road, Fort,Bombay 400001. (Distt Karira-Gujarat)	31.8.79 (NA/SE)	*Substantial Expansion* 1. Transistors & Diodes (Up to 1 amps)	15.0 M nos. (additional capacity)
		New Articles	
		2. Power Transistors	1.0 M nos.
		3. Diodes/Diacs (Greater than 1 amps and less than 30 amps.)	0.3 M nos
		4. SCRs/Triacs (Less than 30 amps.)	0.3 M nos.
		5. LEDs	
		(a) Lamps	1.0 M nos.
		(b) Digits	1.0 M nos.
		6. Microwave diodes	0.3 M nos.
		7. Integrated circuits	2.0 M nos.

NA: New Article NU: New Undertaking SE: Substantial Expansion

FOREIGN COLLABORATIONS

(Approved between April 1979 to June 1979)

Approved during	*Name & Address of the Indian firms*	*Name & Address of the foreign firms*	*Items of manufacture*
April-June 1979	Hyderabad Electronic Instruments Ltd, 6-3-246/1 (Road No. 1), Banjara Hills, Hyderabad	Koneoy Instruments Division Ruukintie 18 SF-02320 Espoo 32, Finland	Electromedical equipment (Memory monitor)
April-June 1979	Punjab State Electronics Dev. & Production Corpn., Bank of India Bldg, Bank Square, Sector-17, Chandigarh.	General Medical Merate SPA Viz, Partigiant-25-Senate, Italy.	X-ray image intensifier systems.

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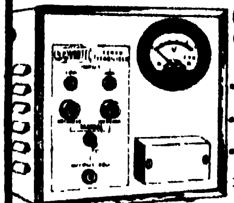

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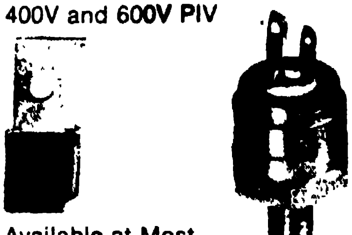

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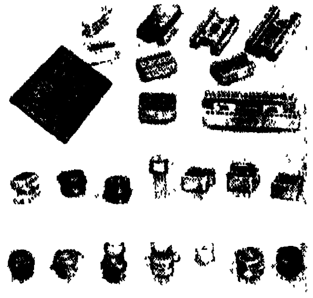

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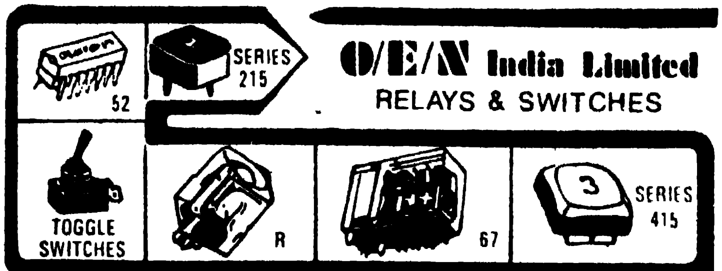

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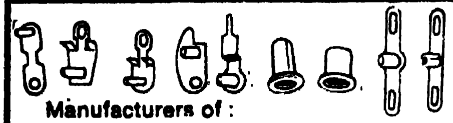

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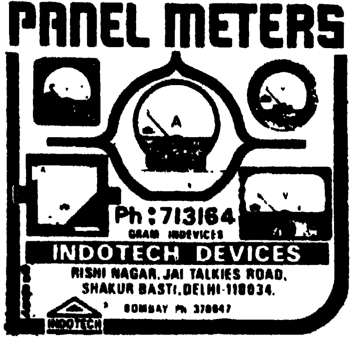

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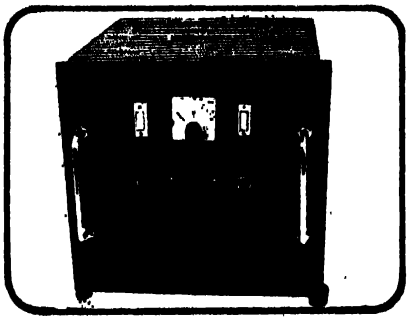

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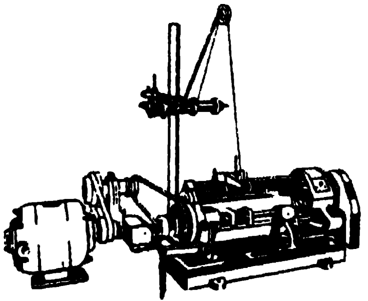

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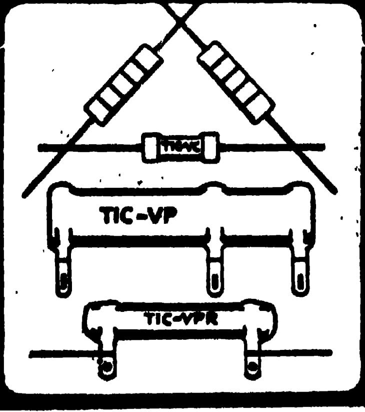

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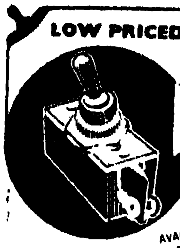

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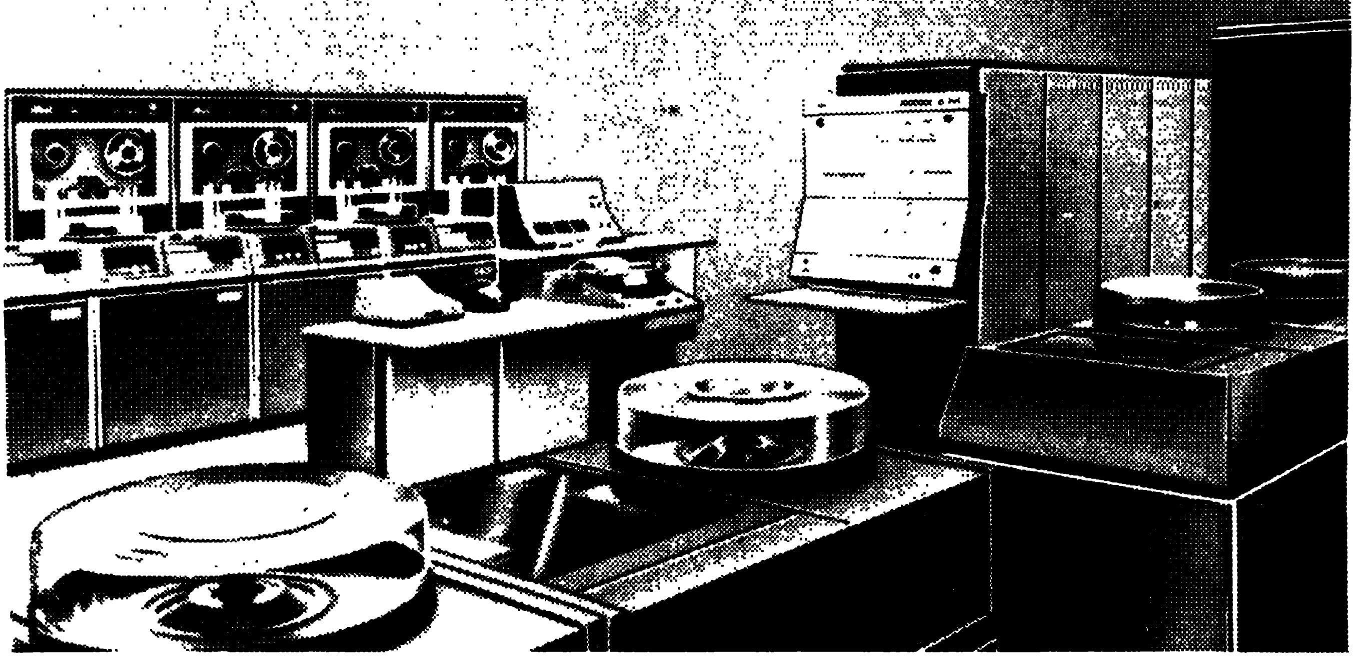

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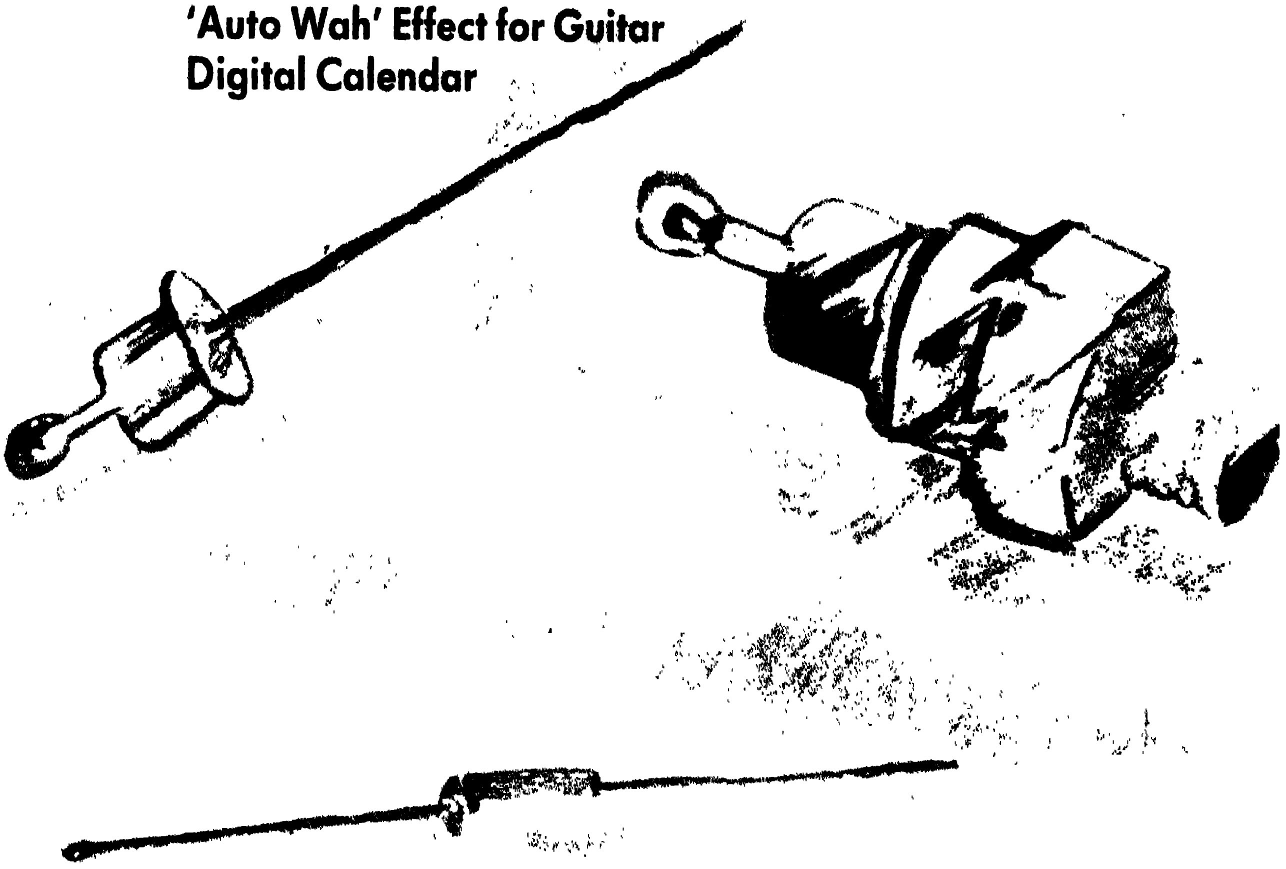

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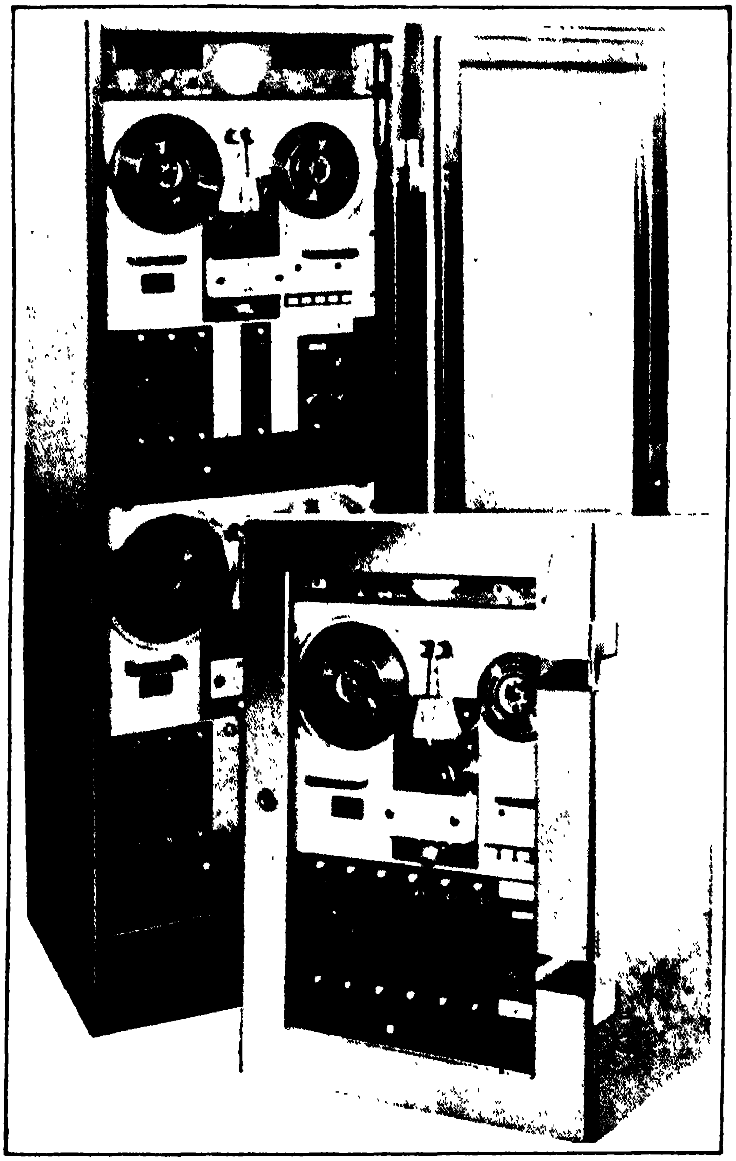

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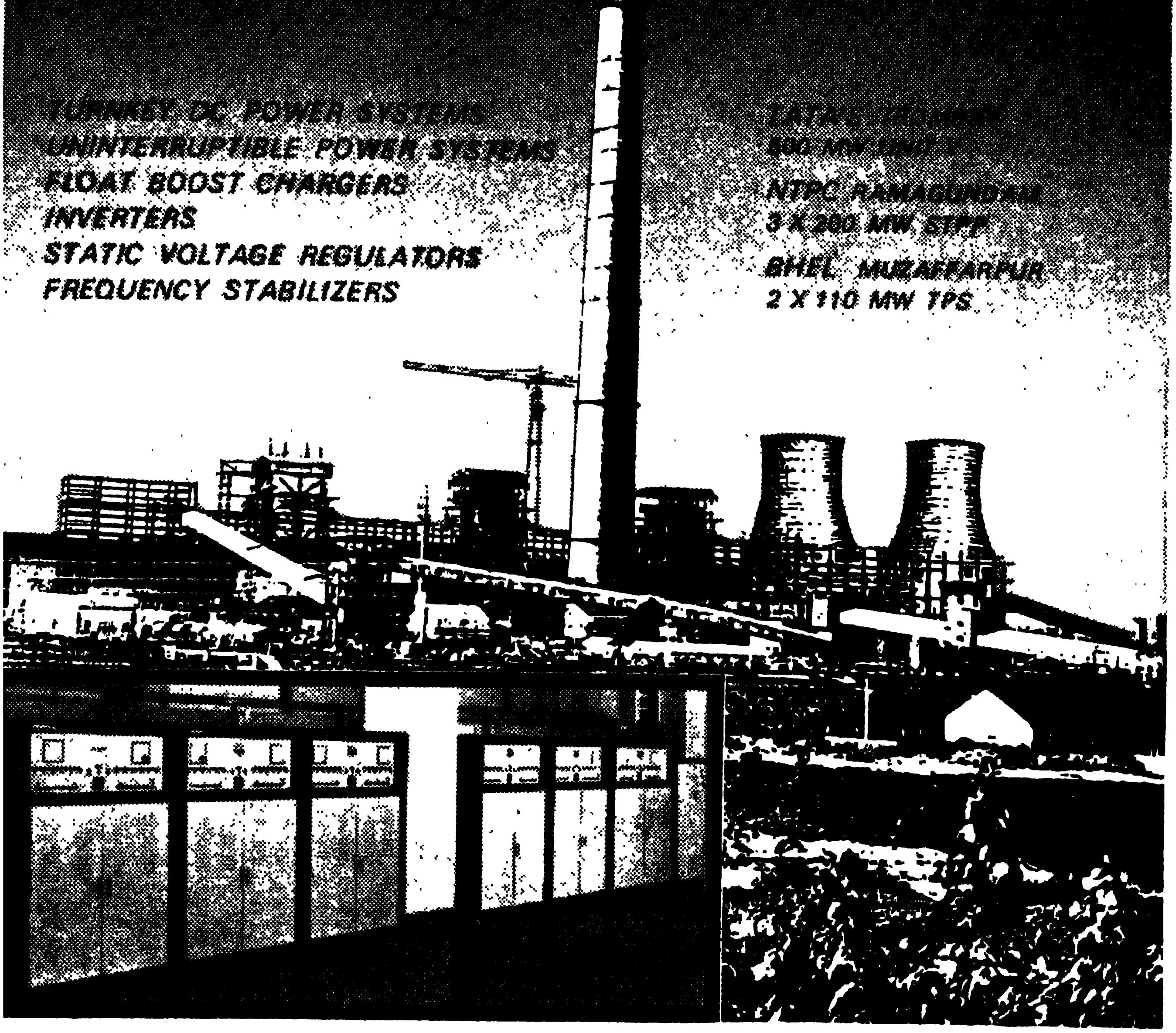

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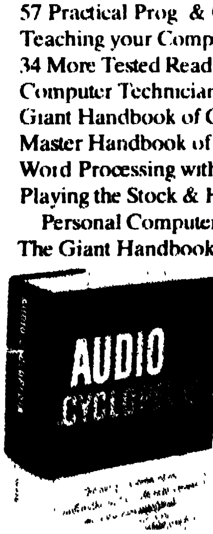

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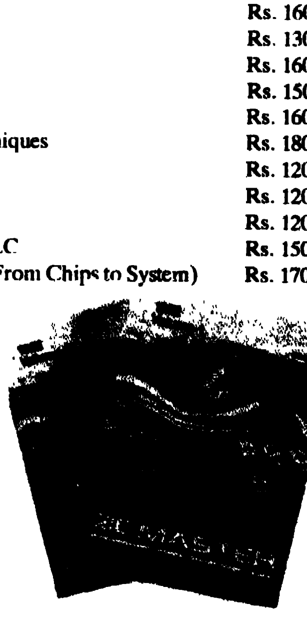

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Zener Principles Revisited (Part-I)

A.V. Jacob

Zener diodes are nowadays being used extensively in circuits, but sometimes without completely understanding their significance and effect on the circuits. This first part of the two-part serial is intended to improve the readers' understanding of this mysterious device. The second part in May issue will illustrate its application through a number of circuits.

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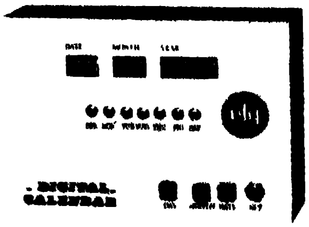
'Auto Wah' for Your Guitar

Manoj Damani and Mujeeb Dadarkar

This is basically an automated 'Waa-waa' pedal which imposes the Waa-waa sound on the instrument played through it, at a rate determined by a variable control. At a very fast rate, it produces an effect similar to that produced by much more expensive 'Phasers' available in the market.

53



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D. Linga Reddy

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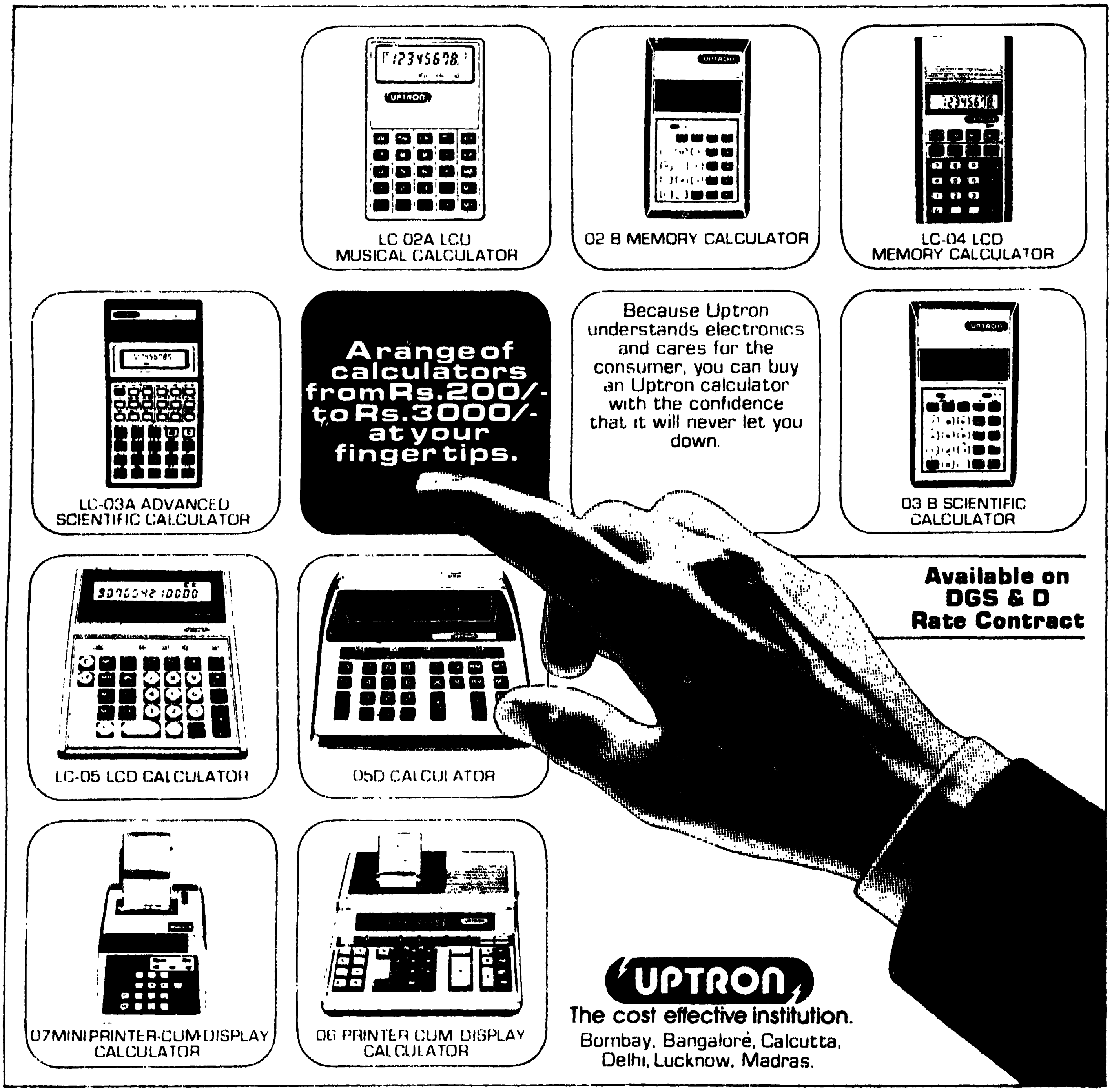

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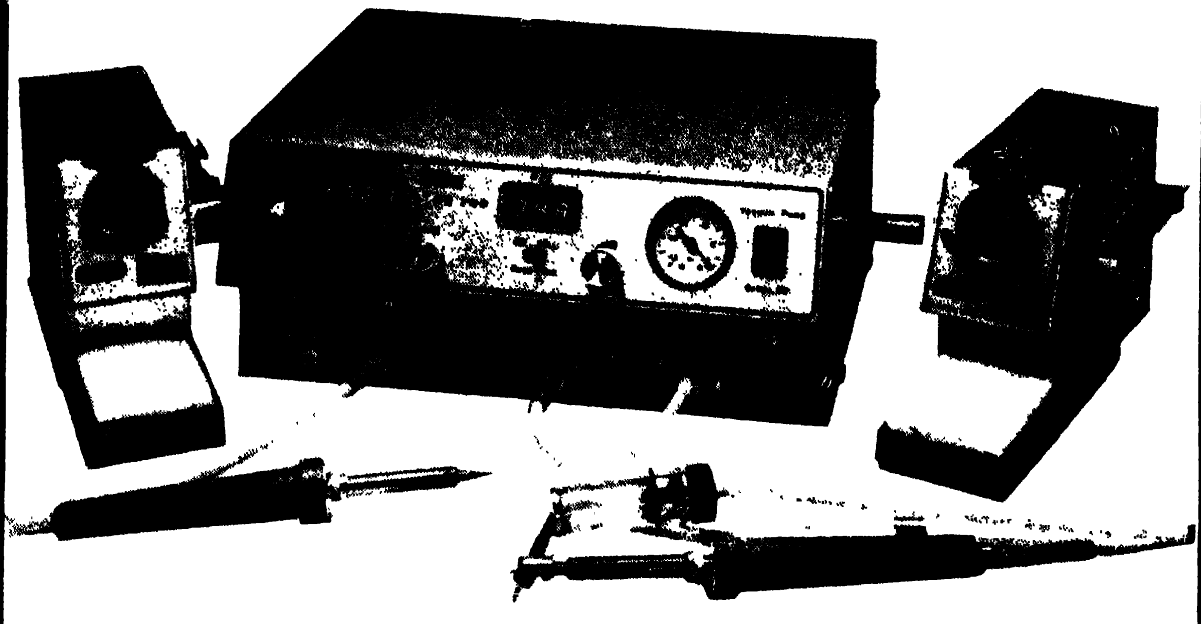

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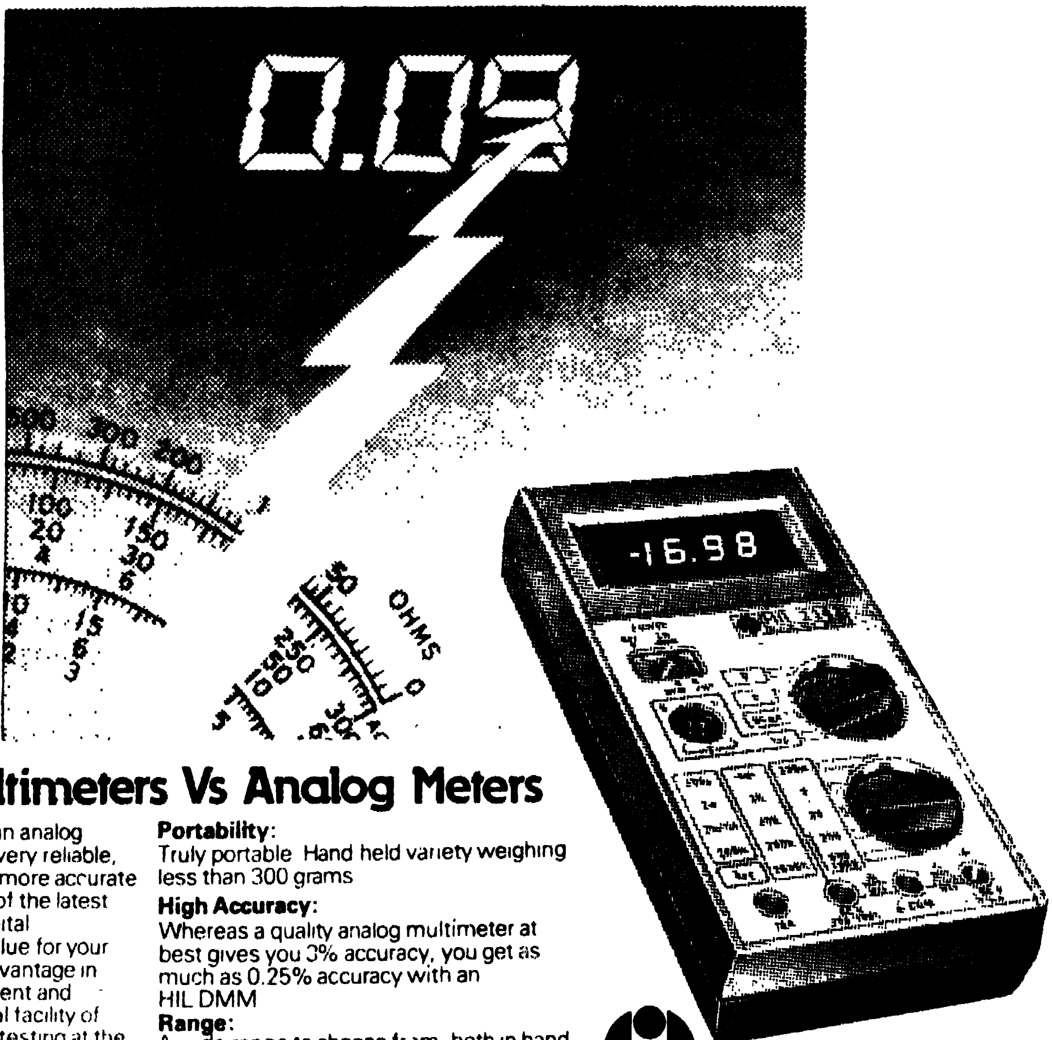

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ARMS/D/321

letters

TRAFFIC SIGNALS

With respect to the Automatic Traffic Signal model published in Aug. '82 issue, there is one possible improvement. In your circuit the amber light lights up only before red light changes to green. In some places, it also lights up when green light is to change to red.

This modification is possible in the circuit given by you, by merely interconnecting pins 11 and 6 of IC4. With this change, the amber light also lights up two seconds before green goes off, so that there is a warning that now green signal is about to turn red.

B.R. BADWE
Ambajogai

VOLTAGE MEASUREMENT

The article on 'Voltage Measurement on Nonsinusoidal Waveforms' by Mr R.S. Chimni in Jan. '83 issue clearly focussed attention on various pitfalls, precautions and procedures during measurement on non-sinusoidal waveforms.

But what will be the result of measurement when a sinusoidal waveform is measured on a conventional RMS calibrated meter after it has undergone half- or full-wave rectification? As some of EFY readers may be interested to know, please permit me to illustrate the following:

The characteristics of full or half sinusoidal rectified wave is quite simple and is clearly known. But for proper interpretation of a result of measurement, it is not enough if the characteristic of the wave alone is known. One should also know the type of meter and how it responds.

Suppose we use a VTVM HP type 410B. In this VTVM, conversion of AC into DC is accomplished employing a shunt rectifier with a filter. It would only indicate $VP/\sqrt{2} \times (1\text{-}1/\pi)$ on half-wave rectification and $VP/\sqrt{2} \times (1\text{-}2/\pi)$ on full-wave rectification

Thus, if one feeds half-wave rectified voltage having 10V peak, the reading will be 4.83V. On the other hand, if 10V peak full-wave rectified voltage is fed, the meter reading would be only 2.57V.

Now, if we feed the above waveforms to a true RMS meter, what will be reading like? In case of 10V peak full-wave rectified sinusoidal voltage, it is just the same as non-rectified sinewave, i.e. $VP/\sqrt{2} = 10/\sqrt{2} = 7.07V$. But when half-wave rectified sinusoidal voltage is fed, the reading will be only $VP/2$ and not $VP/\sqrt{2}$. Hence, 10V peak half-wave rectifed sinusoidal voltage will be read as $VP/2 = 10/2 = 5V$ on a true RMS meter.

Further, if RMS ripple measurement is to be carried out, a true RMS meter alone must be used with a capacitor in series with it to block the DC component of voltage, allowing the meter to read only the alternating components.

G. THAYUMANAVAN
Bangalore

CHROMIUM DIOXIDE TAPES

The article 'Performance of Chromium Dioxide Audio Tapes' (Feb. '83) is biased in favour of CrO_2 tapes as it does not give the complete picture about CrO_2 and Fe_2O_3 tapes.

Many grades of Fe_2O_3 tapes such as 'Avilyn' have been developed with higher coercivity and retentivity. There is also no mention of an important physical property, i.e. hardness of the two oxides. The CrO_2 is much more harder than Fe_2O_3, resulting in head wear rate of 5-10 times more than Fe_2O_3.

RAHUL KUMAR
Chief Engineer (Chemical)
Letape (India) Pvt Ltd
New Delhi

GRAPHIC EQUALISER

Some omissions have occured in the published version of my Graphic Equaliser circuit in Jan. '83 issue. Readers may please note the following:

1. The equaliser may be operated off 18- to 24-volt power supply, but preferably 24-volt. If this supply is being derived from the same power supply that operates the rest of the amplifier, then it should be suitably decoupled.

2. The capacitor connected across the tone potmeter should be ten times the value of the capacitor connected to the wiper of the potmeter. Thus, for the 30Hz band we have the wiper capacitor C1 as 0.02 μF, and so the capacitor across the potmeter should be valued 0.2 μF

3. Capacitor C2 in the table is valued 0.006 μF (6 kpF) and not 0.6 kpF.

EDWIN FARIA
Goa

100-WATT INVERTER

A line interconnecting the collectors of transistors T4-T7 to the centre-tap of inverter transformer (X2) was found missing in the circuit forming a part of my article in Jan. '83 issue. Readers are requested to make a note of this correction. Sorry for the inconvenience!

PRADEEP SHARMA
New Delhi

LED CONTROL CIRCUIT FAULT INDICATOR

In my circuit in Jan. '83 issue, S1-S4 are indicated as 'microswitches' while they should have been indicated as earth rod microswitches.'

K.A. SHAIKH
Rajkot

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what's new

In India...

Electronics production in India crosses the Rs 10 billion mark

Mrs Indira Gandhi informed the Rajya Sabha recently that the production of electronics items during 1982 was provisionally estimated at Rs 10.5 billion (1 billion = 1000 million). The production of 10 state electronics corporations in 1981-82 was around Rs 0.9 billion but they were expected to reach the level of Rs 2 billion in the next three years. She also said that the production of electronics goods is expected to record a growth rate of 25 per cent a year in the coming years.

Effect of new baggage rules on the components industry

An analysis of the effect of the new baggage rules announced in the latest budget, makes import of TVs, tape recorders and two-in-ones, as baggage, an extremely attractive proposition, according to ELCINA. The duty rates fixed for these items are now much lower than the special rates for CTV at the time of the OGL imports during the Asiad. It is noticed that the consumer electronics industry, especially the manufacturers of TVs, tape recorders and two-in-ones, will be hit badly and this cannot but have a negative effect on the growth of the components industry.

According to the new baggage rules (Customs Notification No. 58/March 1983), the duty-free allowance will be Rs 1250, and any excess will be charged a basic customs duty at the rate of 130 per cent for the first Rs 2000 and at the rate of 200 per cent on the balance. In addition, it is understood from the Ministry of Finance and the Customs PRO that an auxiliary duty of 35 per cent (not CVD) will also be charged. Thus, the overall duty on the first Rs 2000 works out to be 165 per cent and on the balance to be 235 per cent. This may be compared to the hitherto existing duty rates of over 300 per cent, lower duty free limits and restrictions on the import of certain consumer electronics items.

Table below compares the imported cost of items such as MW radios, 30.5cm, 35.5cm and 51cm B/W TVs, 51cm CTVs, mono/stereo tape recorders and two-in-ones and VCRs with the Indian prices of equivalent models. It will be noticed that except for 51cm B/W TVs, CTVs and VCRs where duty will have to be paid, 30.5cm B/W sets, mono and stereo tape recorders and two-in-ones will be exempt from any duty as their cost is well below the duty-free limits.

	Estimated international prices (US $)	(Rs)	duty + auxiliary duty (Rs)	Total (Rs)	Estimated prices of equivalents (Rs)
30.5 cm/35.5 cm B/W TVs	[illegible]	800	—	800	1750
51 cm B/W TVs	[illegible]	[illegible]	[illegible]	1912.50	2400 to 4500
51 cm CTVs	[illegible]	[illegible]	[illegible]	5387.50	8000 to 9500
VCRs	[illegible]	[illegible]	[illegible]	7300.00	12000 to 15000
[illegible]	[illegible]	[illegible]	—	[illegible]	500 to 600
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	900 to 1200
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

US market has potential for Indian electronic products

Indian firms manufacturing electronic components have got a good potential to supply low technology and labour intensive items to the US market. This is the finding of a market survey recently conducted by the Engineering Export Promotion Council (EEPC).

In the high technology area, the market is shared by local producers and exporters of Japan and some European countries, but in the low technology area, the market is shared by local manufacturers and the South East Asian countries. The American importers are not biased against Indian suppliers.

The parameters for success are large production, good quality, pricing and prompt delivery. The major part of the electronic components industry in the US today is integrated circuits. The ICs have not only displaced many components like transistors, resistors and capacitors but have made products like electronic watches, pocket calculators etc feasible due to the use of ICs.

India to help Nepal in setting up electronics industry

Mr D.P. Gautam, acting secretary in Nepal's Ministry of Commerce and Supplies, stated recently in New Delhi that the governments of Nepal and India were working together to establish a joint industrial committee to promote industrial cooperation between the two countries. He welcomed the offer of the Association of India Engineering Industry to help set up electronics units in Nepal.

Mr Gautam said that 100 per cent foreign equity participation was permitted in almost all industries in Nepal with the exception of the cottage industries where some Nepalese participation was essential. There was no duty on imports from India to Nepal except in some industries which had a very high margin of profit.

Under the terms of the treaty of trade with India, exports from Nepal to India were exempt from customs duty if 80 per cent of its contents were either of Indian or Nepalese origin.

UK electronic components industry federation mission to India

A second mission from Britain's electronic components industry federation (ECIF) visited India from March 13 to 31 to follow up the success of the first mission in March 1981.

The 12-company group offered products ranging from variable resistors to microwave tubes and devices. The federation's director and chief executive, Mr William Barrett, said: "Our first mission went very well and certainly confirmed the importance of India as a significant and growing market. It also established the need for a second mission to follow up the successes achieved and the contacts made."

In addition to promoting sales of British-made components — highly competitive in all world markets — the mission examined the possibility of collaborative ventures and interchange of knowhow.

The mission visited Delhi, Hyderabad, Bangalore and Bombay, with individual members also calling at other centres. While in Delhi, the mission members visited the Electronics India'83 exhibition organised by the Trade Fair Authority of India at Pragati Maidan. They had meetings with the Department of Electronics, the Electronics Components Industries Association and the Association of Indian Engineering Industry, apart from members pursuing their individual business interests.

The ECIF represents manufacturers of electronic components of all types in the UK. It collects statistics, deals with national and international standardisation matters, discusses issues of common concern with users, organises inward and outward missions, and carries on other activities for the benefit of the membership and the industry. It also publishes a report which lists member-companies and describes their activities in detail and a buyer's guide which lists members' products broken down into detailed categories.

Technical knowhow and training for Indian engineers will be offered by two companies, namely, Graphic Electronics Ltd, and Graphic Circuits International Ltd, which specialise in print and etch, plated-through hole and multilayer printed circuits, and printed wiring boards.

Graphic Electronics Ltd hope to finalise a 25 per cent holding in a joint venture with Precision Circuits (India) Ltd of Santa Cruz, Bombay.

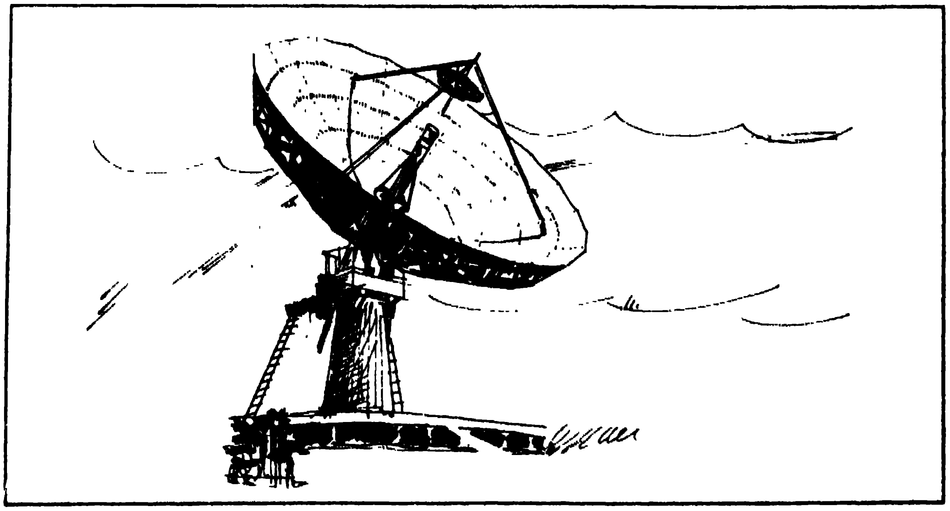
Following the supply of prototypes to another company, this company hopes to conclude a long-term contract for two or three years for the supply of multilayer printed circuit boards, allied to control systems for defence electronics.

Another company which claims to be the largest specialist semiconductor designer and manufacturer in Europe, namely, Marconi Electronic Devices Ltd (MEDL), was represented in the mission by Mr Peter Loweth, export manager. The microelectronic, microwave and power devices which the company makes include specialised custom-designed gate and cell array integrated circuits in ISO-CMOS and CMOS-SOS technology, with full computer-aided layout and design engineering support. It also offers thick film microelectronic and packaging technology for high-reliability and high-volume custom design circuit fabrication.

Agents in India for the company's semiconductor and power products are Usha Rectifier Corporation (India) Ltd, and for microwave and hybrid products for the military, avionics and telecommunications fields the British firm is represented by the English Electric Company of India Ltd, Bangalore. MEDL has a licence agreement with Usha for the production of power thyristors and rectifier diodes, along with their associated cooling accessories.

SLV-3 to be launched in April

The satellite launch vehicle, SLV - 3, to be launched from Sriharikota in April as scheduled would use the latest charged couple device for sensing



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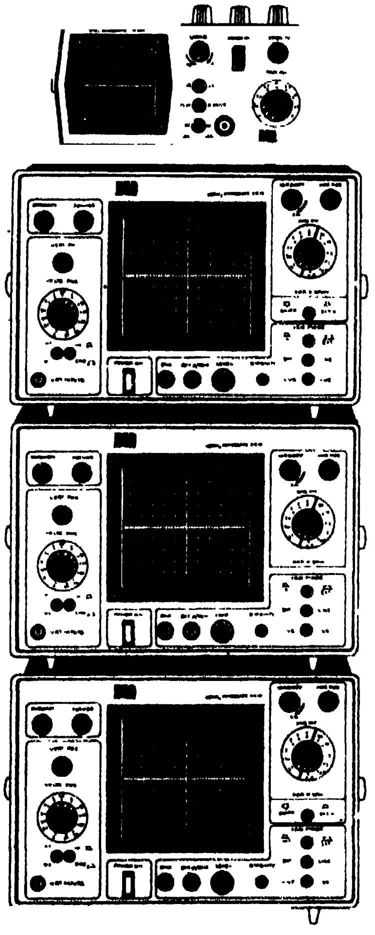

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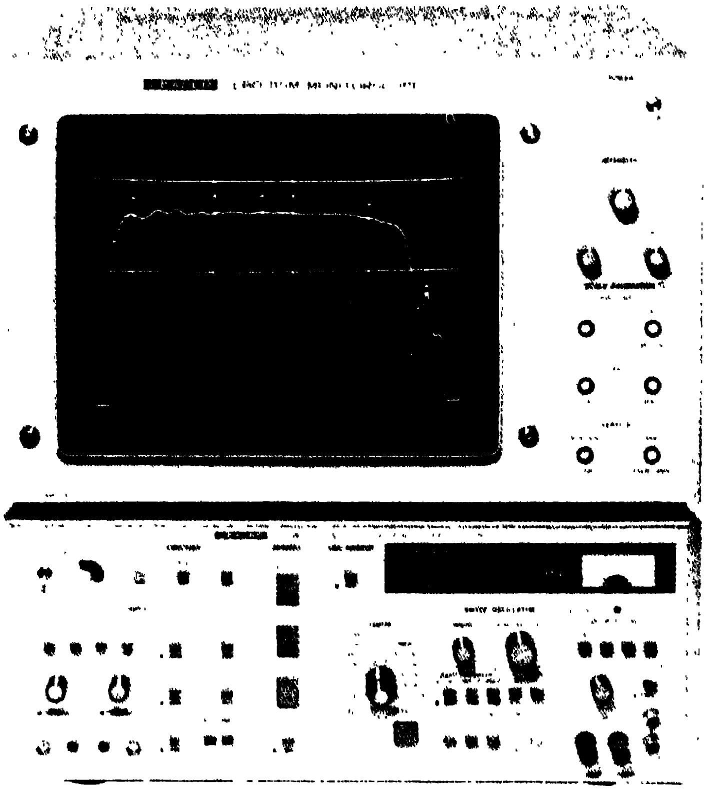

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According to Prof. U.R. Rao, director of the Indian Space Research Organisation (ISRO), the device based on solidstate technology, was a type of camera to be used for measuring parameters like vegetation and forestry patterns and hydrology.

The tiny device, comprising over 2000 elements, eliminated the problem of voltage fluctuation. Besides, it consumed only 10 to 15 volts.

According to Prof. Rao, the device would be incorporated in the first India-made remote-sensing satellite IRS-1 to be launched in 1985-86.

IRS – 1 would be the second major satellite to use the device. The first would be 'SPOT', a French satellite to go up by the end of 1984.

APPLE'S life coming to an end

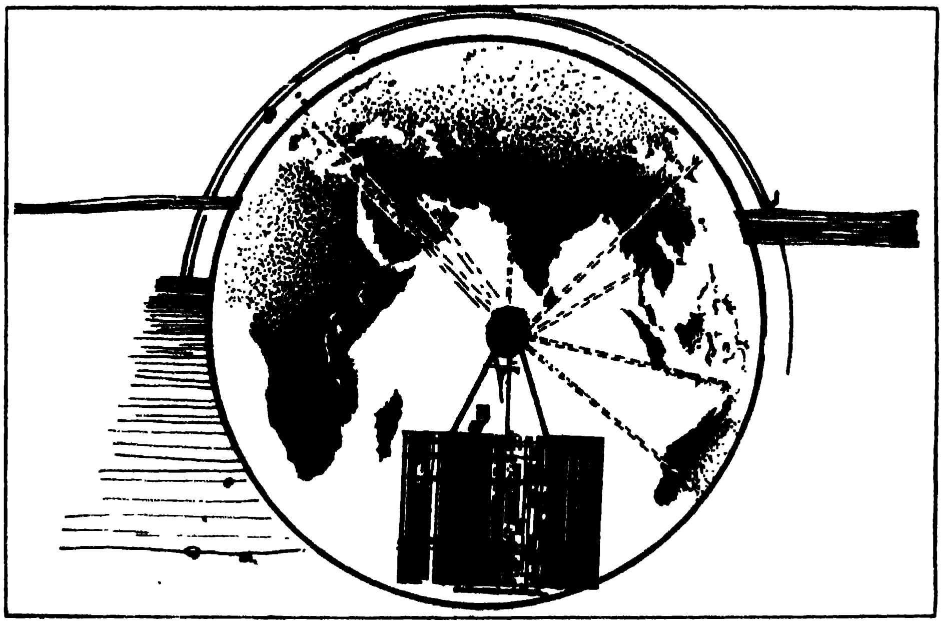
The country's first experimental communications satellite, APPLE (Ariane Passenger Payload Experiment), is set to achieve its mission goals with the successful completion of most of the experiments lined up for it.

A forerunner of the country's satellite-based communication system, APPLE is fast nearing the end of its envisaged life term of two years. Despite a crippled solar panel, the spacecraft has worked normally since its launching from Kourou in French Guyana in June 1981.

According to the APPLE project director, Mr R.M. Vasagam, the satellite was being switched on for about eight hours a day and was functioning normally. The performance of the on-board payload was also satisfactory.

The satellite was used for nationwide telecasting, and certain technical experiments vital for future satellite-based telecommunications in the country were carried out successfully.

Another application was facsimile printing. 'The Hindu' daily newspaper had availed of this facility to print its Bangalore edition for a brief period. A paper mill in Orissa successfully used APPLE for computer interconnections and data transfer.



Technical experiments successfully carried out include time division multiple access (TDMA) and spread spectrum multiple access (SSMA) which help to increase channel capacity in communication.

The technology allows the use of a single radio frequency carrier by a number of stations using non-overlapping burst of information. It would ensure increased flexibility and reliability in communications.

INSAT-IB to be launched in August-September

INSAT - IB, India's second operational multipurpose satellite, will be launched in August-September this year from the United States, according to the director of the Indian Space Research Organisation (ISRO), Prof. U.R. Rao.

Any delay in the schedule of the US-space shuttle would cause delay in the launch of INSAT - IB also. Its launching depends on the space available on the United States space shuttle.

According to Prof. Rao, all the tests had been successfully completed and a final checkout would be made in California before the launch.

Electronics for the development of rural society

In view of the challenge of increasing population each year, the agricultural sector — the mainstay of India's economy — has to be provided with a technological support, including the support of electronics, according to Dr M.S. Sanjeevi Rao, deputy minister of electronics and also chairman of the Electronics Commission.

Dr Rao inaugurated a symposium on "Rural Development through Electronics" in Chandigarh on March 7, 1983 He said that in a broad sense rural electronics would mean application of electronics for the betterment of the quality of life in our villages. For example, agriculture should include dairy and livestock, education, health and medicine, communication and entertainment, solar energy and generation of employment through electronics industry in small-scale and cottage industries.

ELCINA recommends the establishment of development fund

The government of India should set up a Rs 150 million fund for the development of the electronic components industry, to be used for setting up new units as well as for modernisation of existing ones.

This is one of the major suggestions made by the workshop on 'Investment for faster growth of the electronic components industry', organised recently by ELCINA in New

Delhi.

The workshop suggested that an interest subsidy of five per cent should be provided from this fund to help large units become viable in the initial years.

The custom duties on capital goods should be deferred for a period of five years to keep the cost of new projects low. This proposal could be implemented through the mechanism of the proposed fund.

It was noted that large capacities could become viable only by exporting some output till demand picked up in the domestic market.

The government should, thus, provide a subsidy of at least 10 per cent on exports to new units during the initial five years.

The workshop also recommended setting up of an advisory committee, comprising representatives of official agencies and the industry, for reviewing the growth of the latter.

It was observed that the facility of Rep. licences was being used by some trading houses for 'legal smuggling' of components, much to the detriment of domestic units. The Rep. scheme should thus be carefully regulated and monitored.

And Abroad...

Computers at $ 50 a piece in USA

Computer prices have crashed in the USA making some brands as cheap as calculators. A major Washington department store has advertised the Timex Sinclair 1,000 for $ 44.99 (about Rs 450). The list price used to be $ 100.

Meanwhile, Atari announced that by the end of this year it hoped to sell for about $ 300 a telephone with a video display and an attachable keyboard that would let the user send typed electronic messages, play video games and work jointly on computer tasks over phone lines with those who possess similar instruments.

The transformation of the telephone into a computer has been made possible by the recent decision to permit telephone users to own their instruments. The monopoly of the telephone company, too, has been broken with the result that new companies are now competing for the long distance telephone market.

International exhibition for electronic components in Paris

The Salon International des COMPOSANTS ELECTRONIQUES will be held at the new North Paris Exhibition Grounds from Monday November 14 to Friday November 18, 1983. It will present two major sectors: (i) electronic components and sub-assemblies, passive components, semiconductors, electronic tubes; (ii) electrical and electronic measurement: analysers, recorders, captors etc.

Equipment and products for electronics will be displayed in a new specialised independent exhibition 'PRONIC 84', which will take place at the Porte de Versailles Exhibition Grounds from November 20 to 23, 1984.

Holidaying with computers

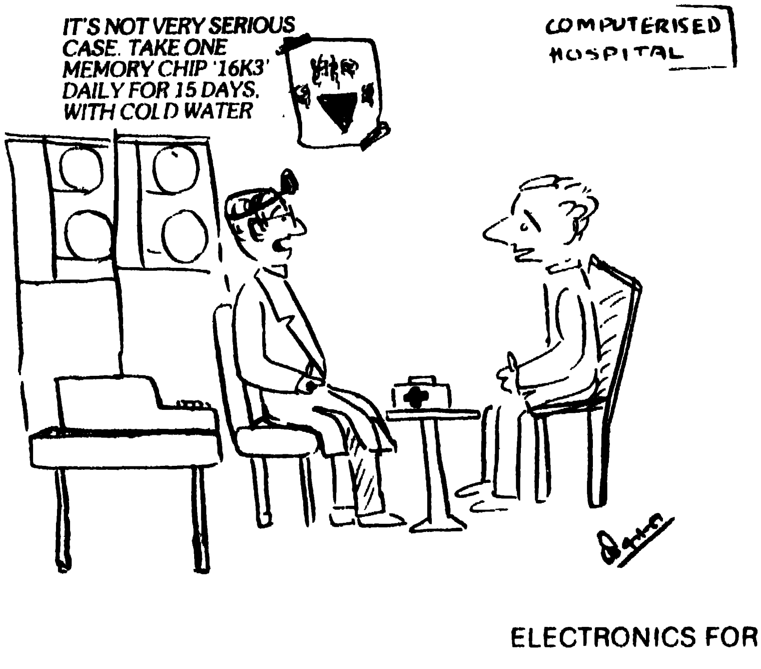
How to programme and operate a computer may seem like hard work to some, but to others it is their idea of having a good time.

Even Dr Lionel Wardle, whose Computer Holidays Company runs such courses at Southampton University, in Southern England, has been surprised by its popularity.

These computer courses were originally offered to those living in Britain, but people overseas heard about them and came last year from countries as far as Belgium, Mexico, Brazil and Austrlia. This year he has decided to promote them internationally, sending out information in English and French. A Spanish version is also being prepared.

"We are trying to develop awareness and understanding of computers in a practical way and to push forward computer literacy", says Dr Wardle, who with his wife and other experts give the tuition.

Sales of microcomputers for the home have soared in the UK and many other countries, but Dr Wardle thinks that many people do not know how to make the best use of them. He also feels that small businessmen need advice to avoid making the wrong choice of systems. Specific courses for various professional groups are being arranged as well as general ones for the beginners and more experienced programmers.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Doctors, dentists and retail chemists are being catered for during the Easter vacation at Southampton University, while "creativity with the computer" will deal with colour graphics, animation and design.

Groups to be invited during the summer holidays in July and August include architects, surveyors and motor traders. Another topic is strategic planning for managers and executives.

Families are encouraged to come along even if they do not wish to study. "For instance, a father and son may want to learn ,while mother makes use of the campus's recreational facilities", Dr Wardle explains.

Audio & Video Fair in Berlin

"The next Audio and Video Fair is becoming a reality: every available space has already been booked, not only on the entire Exhibition Grounds, but also in the International Congress Centre". Five months before the opening of the International Audio and Video Fair Berlin 1983, the world's largest event for TV, video and hi-fi, the executive company responsible for this event, AMK Berlin. was able to confirm this fact at the second working meeting of the Exhibition Committee. Expressed in figures this means: from September 2 to 11 this year, 25 exhibition halls with an overall floor area of approximately 90,000 square metre are already fully booked. This event will also make use of the 40,000 square metre of open space and the 80 rooms in the ICC Berlin.

Every thing that the leading countries in the electronics field in Europe and overseas have thought up for consumer, information and communication electronics in the home can be seen and heard in Berlin. TV sets, especially those with stereo sound, will occupy the foreground. To an increasing extent the television set is becoming a central component for numerous different uses. Apart from the customary reception of television programmes, it can serve as part of a compact audio-video centre, for cable and satellite TV, for screen-based communication and information facilities such as Bildschirmtext and teletext, for video recorders and video discs and of course for screen games and home computers too.

All in all, one can expect to see several thousand screens in operation at the coming Audio and Video Fair, offering a wealth of programmes from the broadcasting authorities, as well as those on cassette and disc, along with made-up computer games. So far approximately 1.2 million stereo colour television sets have been sold on the German market, and such sets will be on display, incorporating the new digital technology.

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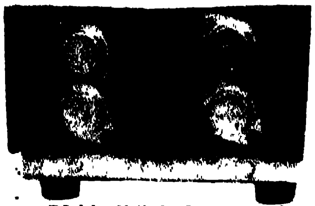

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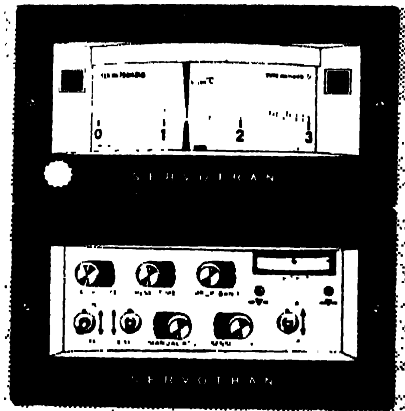

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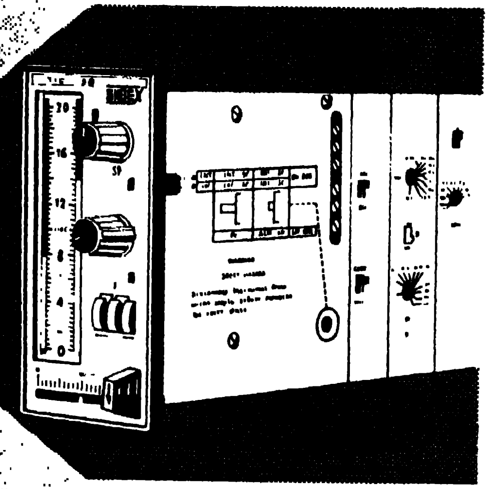

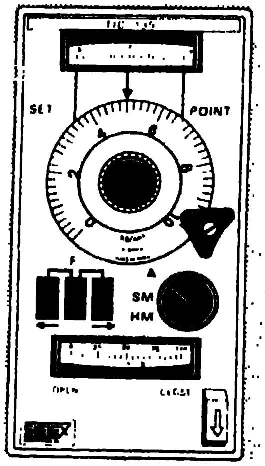

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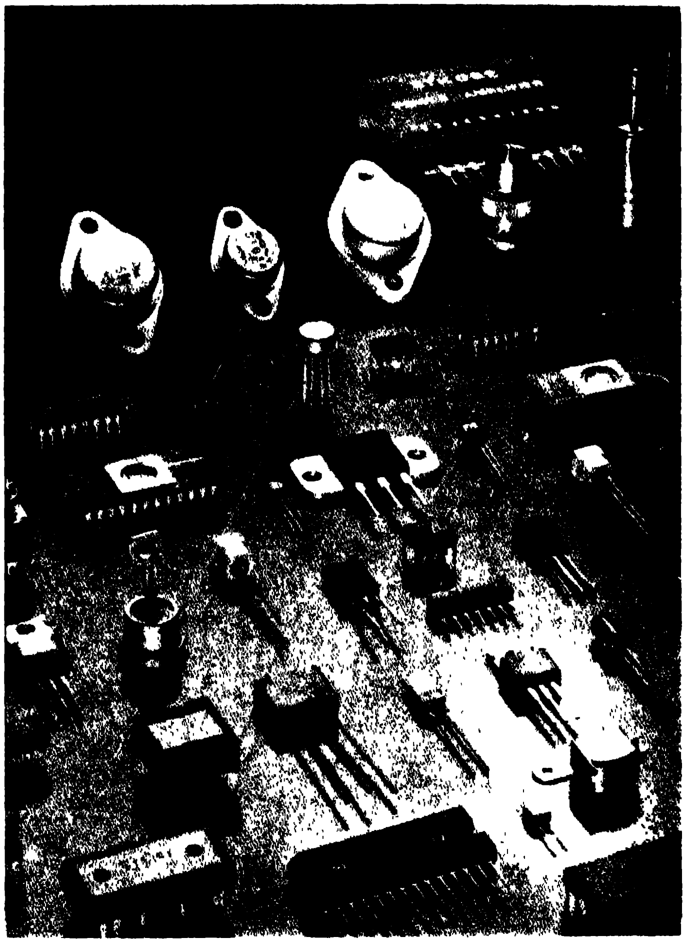
SOUTH KOREA:
Is It Worth Emulating?

R. Chandrasekar



Observers of electronics industry in this country would have noticed the frequent mention of South Korea as a success story in electronics - both in production and exports. Here, this article sets out to test the hypothesis whether South Korea is really an example worth emulating.

Indian electronics – the beginning

Electronics goods production was started in India by some enterprising refugees from Pakistan in Delhi by the assembly of radios from imported kits in the early 1950's. South Korea started the assembly of radios from the imported kits only in 1958. The economic priorities of the 50's and 60's in India were tuned to develop the heavy industry and agriculture. No doubt, those priorities have paid rich dividends in the wake of constant population explosion. But if electronics alone is considered, even after 10 years of experience in the manufacture of electronics, in 1964-65, total Indian electronics production was not more than Rs 390 million. In the initial stage, the experience of South Korea had also been similar. In 1965, there were only 40 electronic companies in Korea, producing some Rs 100 million worth of goods.

Both in India and South Korea, the emphasis was mostly on an inward-looking, import substitution development strategy. The electronics industry was no exception to this. And because of this deliberate policy, both in India and in South Korea, the result was a very low growth rate of electronics.

1969 – the year that was

South Korean government enacted a law, i.e. 'Electronics Industry Promotion Law,' which explicitly recognised electronics as a 'strategic export industry' in 1969. A comprehensive plan of development was drawn up for 1969-1976. In India also, during the same period, Bhabha Committee on electronics was set up, which was almost identical in the charter and responsibility of the similar committee in South Korea.

As a subsequent development, a separate Department of Electronics was created in 1970 and the Electronics Commission (in line with the Atomic Energy Commission) in 1971 in India.

The production performance in both the countries was almost the same till 1967. In fact, from 1968 till 1971, India was leading in electronics production.

The main difference in the approach to the same problem by the two different countries was in one respect, namely, the domestic requirements were accorded priority in India whereas in South Korea it was 'exports'.

The seventies

South Korea overtook Indian electronics production in 1972. In 1971, South Korea could achieve only 65 per cent of what India did. But in 1974, the picture was totally different. India produced Rs 3010 million worth of electronics goods which were a paltry 40 per cent of South Korean production.

The differences were showing in the productmix when (in 1971) South Korea concentrated on Colour TVs (23 per cent) and components while India concentrated on radios.

In 1970, in both the countries the same number of personnel were employed in electronics industry. South Korean exports were 64 per cent of production. In India, the exports were at a very meagre level. (Even in 1972–73, only 2.8 per cent of production was exported.)

Mr R. Chandrasekar is now working as area manager – South, with Motwane Private Limited at Bangalore. Earlier he was with Bharat Electronics Limited, Bangalore, as a senior engineer (Planning & Coordination). This article is solely the personal view of the author and not of the organisation he is currently working for.

The momentum which the Korean electronics industry generated in the 70's pulled that nation to the 11th position in the world in terms of manufacture of electronic products.

The eighties

In 1981, South Korea produced electronic goods worth Rs 37,910 million out of which goods worth Rs 22,180 million were exported. The introduction of colour TV broadcast was a welcome step to boost its domestic sales. The time-tested Korean colour TVs were available in Korea for Korean buyers. About 57.5 per cent of the production was by the domestic companies while the rest was in the hands of joint-ventures/foreign subsidiaries.

In the exports field, the domestic companies had a comparatively lesser share. The items exported from South Korea include black and white TV, colour TV, record players, car stereos, amplifiers, batteries, ICs and electronic watches. (Total export of consumer items was Rs 11,100 million.) The export of computers, communication equipments, vending machines, telephone recorders, electronic instruments, telephone switching systems and transreceivers also was substantial in 1981 (Rs 1450 million)

In components and parts, the foreign companies are the leaders. This is mainly because of the fact that Korean labour is very cheap. So, more and more foreign companies set up their plants in Korea.

[illegible]

Rank	Item	[illegible]	[illegible]
1.	B/W TVs	[illegible]	[illegible]
2.	ICs	[illegible]	[illegible]
3.	Recorders	[illegible]	[illegible]
4.	Colour TVs	[illegible]	[illegible]

Exports of the components were valued at Rs 9410 million, the main item being the integrated circuits (36.5 per cent of the total).

In India, the picture is entirely different. In 1981, the total production of electronics was worth only Rs 8560 million out of which consumer electronics was Rs 2460 million (29 per cent), computer control and instrumentation sector Rs 1885 million (22 per cent), communication and broadcast equipment Rs 1540 million (18 per cent), aerospace and defence electronics Rs 690 million and electronic components Rs 1730 million (20 per cent).

In the consumer electronics sector, radios (6.53 million) and TVs (0.435 million) are the major items in production (76 per cent) Digital watches, VCR, video games, colour monitors, video cameras, CCTV systems, electronic projectors, electronic flash-guns, fan regulators, battery eliminators, emergency lanterns, STD barring equipment and TV booster amplifier are also being manufactured in India, though on a very small scale. In the field of components, the setting up of the semiconductor complex was delayed which resulted in loss of opportunities. The setting up of indigenous production capacity for the glass shell for TV tubes has further been delayed.

In the field of electronics exports, even though India can boast of a very large product range like radio receivers, tape recorders, calculators, PA systems, communication equipment and different type of components, the total export was worth only Rs 564 million, which is 2.54 per cent of South Korean export (1981).

[illegible]

In spite of the fact that in India there has been a lot of talk on export of software and 100 per cent export-oriented production, in practice, nothing much has been achieved in the past 25 years. In 1981, when 156,992 persons were employed in Korea, in India more than 200,000 persons were employed to produce only 23 per cent of South Korea's production of electronic goods. This may also be due to wrong choice of products, government policies and priorities, and lack of initiative on the part of investors and entrepreneurs.

[illegible]

Long-term prospect

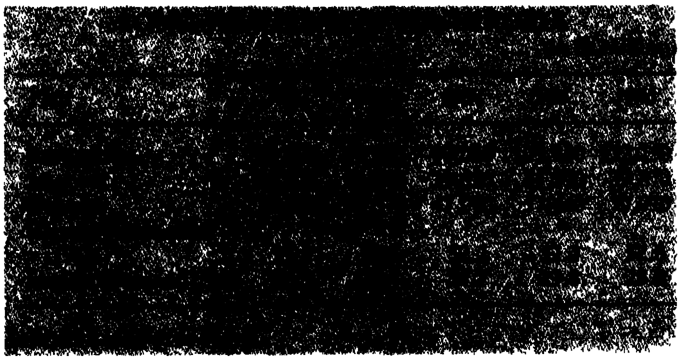
Indian electronics industry has a very ambitious plan. Creation of additional industrial capacity has been the first priority. The Committee on Microprocessor-based Systems, the Task Force on Components, Committee on Electronic Watches, continue to function to implement a balanced growth and also act as nodal agencies for various matters. A Committee of Secretaries has been appointed by the Prime Minister to prepare a comprehensive electronics policy for the decade 1980–90.

The government has built up the R&D base and additional manpower by introducing electronics in various universities and technical institutions. So far, under the Technology Development Council Programme, a total of 220 projects have been funded.

The main constraint is the absence of priority sector status to the electronics industry in India.

South Korea, because of the high priority accorded to the electronics export industry, is having a flourishing electronics industry. Like other advanced countries, the accent in South Korea now is on the improvement of performance in the industrial equipment sector. South Korea proposes to increase its share of the world electronics market from 1.34 per cent (1982) to 1.83 per cent (1986).

The exports of electronic products are expected to be at least 12.8 per cent of the total exports from South Korea (during 1982–86). The dependence on imported parts is expected to decline from 30 per cent in 1980 to 23 per cent in 1986.

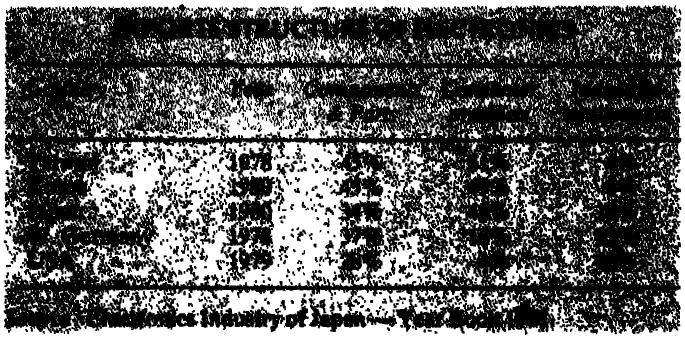


Future plans include the manufacture of complete sub-components, components, office equipment, peripheral computer equipment, computer terminals, etc. The industry is even diversifying its markets. In quantitative terms, South Korea plans to achieve a demand of Rs 170 billion in 1986, out of which Rs 132 billion will be produced locally.

Problems

In Korea, the industry was developed as a sub-contractor for foreign countries. So Korean products were exported under foreign brand names. The designs, parts and components were imported.

The overdependence of the electronics industry on exports has also created problems. So, by expanding the domestic requirements, the problems of uncertainties of overseas markets are expected to be solved.



Korea is facing competition from the developing countries in many areas; its only option in the product-mix is to concentrate on the industrial and professional sector.

Korea depends heavily on Japan for import and the USA for exports. This makes the industry very vulnerable to changes in the policies of these two countries.

In India, since the domestic market is larger than the export market, the problems are different.

Lack of clearcut policy guidelines of operation among the Department of Electronics, the Ministry of Information and Broadcasting, and the Ministry of Communications impedes the growth of electronics industry in India.

In spite of such costly experiments as the SEEPZ, India could not achieve much in the electronics exports field.

India and Korea have some common problems. They are: recent raw-material price rises, high incidence of internal and external taxes, increased competition, trade protectionism, very low scale of operations in many sectors, lack of sufficient R&D and lack of joint ventures abroad.

Conclusion

While India has taken the domestic demand-led growth and has not achieved much, South Korea has taken the export-led growth and has, by and large, succeeded. So, South Korean example is worth emulating.

A very useful inference is that the problems faced by Korea today will be faced by India tomorrow, if it turns to increased export of electronics goods. So the problems faced by South Korea are worth a closer study now.

Further, one may also note that South Korea should try to have more joint ventures in India, in the field of electronics, to offload its technology in consumer electronics and to develop India as a reliable sub-contractor. This will allow South Korea to move into more profitable lines like industrial/professional electronics. India will also benefit in the bargain, by simply boosting its exports activity by leaps and bounds, if South Korean performance on consumer electronics is any indication. ☐

EXPERIENCED
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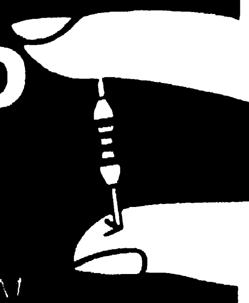

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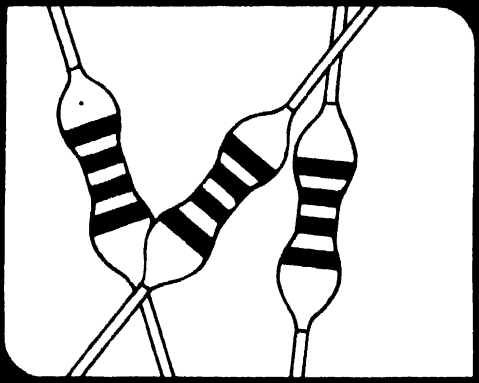

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FIBEROPTIC COMMUNICATION —The Saviour in Telecommunications

Badri Vishal Bajaj

The year 1983 is being celebrated as 'World Communication Year'. There is a growing need for more cable capacity for telecommunications to satisfy the demand for more channels that are required for data transmission, telephone, computer links and for new forms of communications like facsimile transmission. As there are various objections to laying more conventional twisted pair wires or coaxial cables to meet the growing need for increasing capacity, alternative methods of data transmission have been sought. "A revolution in telecommunication is vital to the progress of the country for its economic, for its intellectual and cultural growth", said Prof. S. Nurul Hasan, vice president, Council of Scientific & Industrial Research, New Delhi, recently. The use of fiberoptic approach to data transmission can be the solution with all the advantages we need.

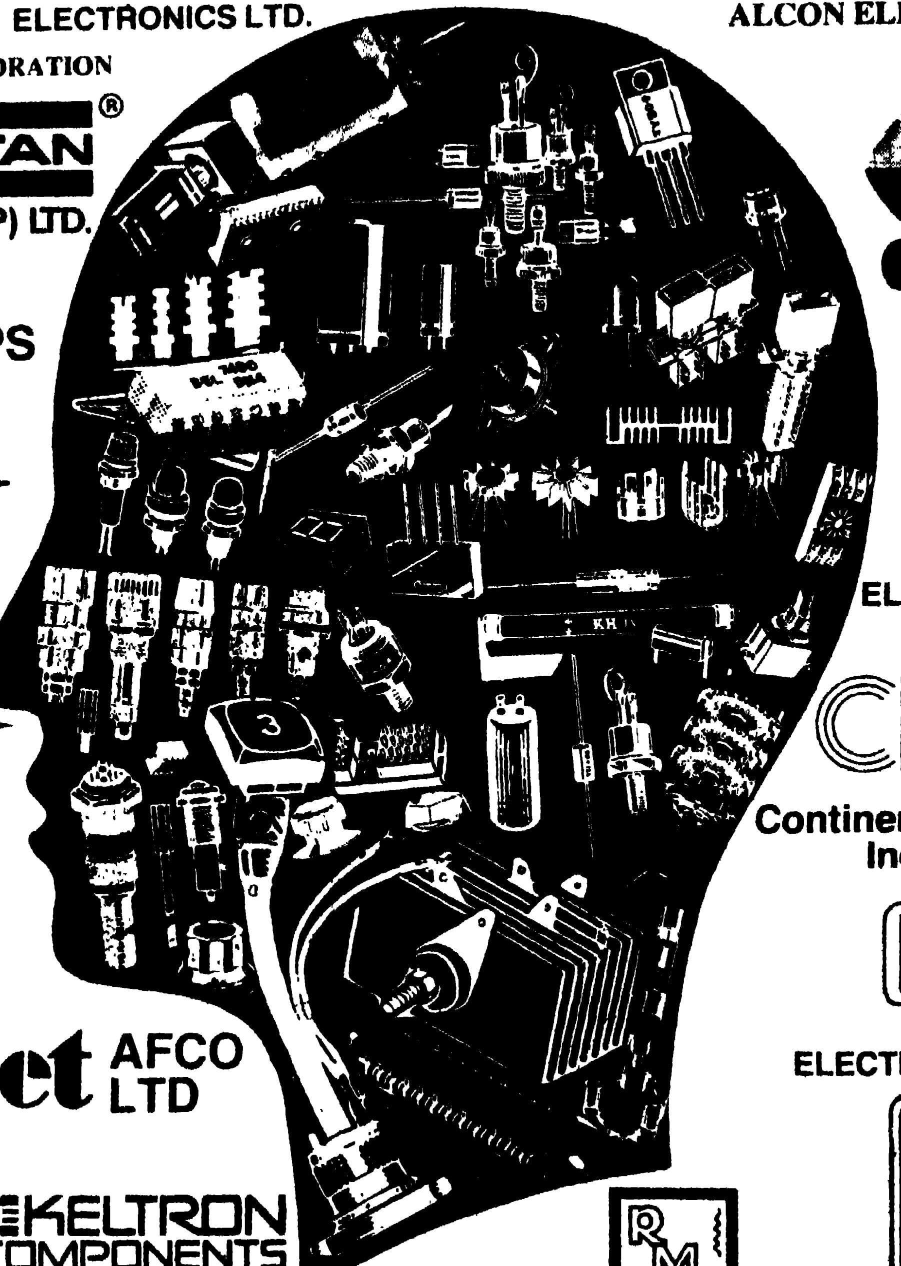
Speaking at the 28th annual general meeting of Institution of Electronics and Telecommunications Engineers, Mr Vasant Sathe, the then minister for Information and Broadcasting, government of India, stressed on: (i) a well laidout communications infrastructure, (ii) maximum utilisation of our communication resources, and (iii) formulating the right policies and approaches to future developments—social and economic—of our country.

Fiberoptics is a fast developing aspect of science and engineering. Though it is at an early stage of development, it holds forth possibilities of increased bandwidth, immunity from interference, isolation, safety, security and reduced size and weight as compared to the conventional coaxial system. In the words of Mr M.M. Wagle, member, P&T Board, government of India, "We are now already in the satellite era. Eighties are going to have optical fiber systems and more to come thereafter. By the advent of fiberoptics systems, new types of disciplines will be automatically creeping in."

It is only 16 years since the paper published by Dr Charles Kao and A. George Kockham of ITT/STL set forth the mathematical basis of optical fiber. They stated that optical communications via fiberoptics could revolutionise the telecommunication industry because of increased bandwidth potential in a noise-free medium. The emergence of the communication era in the seventies brought about a host of new applications for conventional fiberoptic assemblies. The barrier is seen as light's attenuation per kilometre length of fiber cable.

The light as a carrier of information puts at our disposal an enormous bandwidth, i.e. a very large amount of information can be transmitted simultaneously through each fiber. In the development of such optical fiber, the problem was to achieve signal transmission with a minimum of losses/attenuation. The higher transmission capacity or bandwidth can be achieved by a special internal structure of the fiber by overcoming the technical difficulties. In the year 1970, Corning Glass Works were able to manufacture the fiber cable with less than 20 dB/km attenuation using a vapour phase oxidised silica glass. In the year 1974, Valtec Corporation manufactured successfully fiberoptic cable using commercial grade silica. Again in the year 1977, Veltec Corporation,

Mr B V Bajaj is working as a senior technical officer with Instruments Group of Electronics Corporation of India Limited, Hyderabad.



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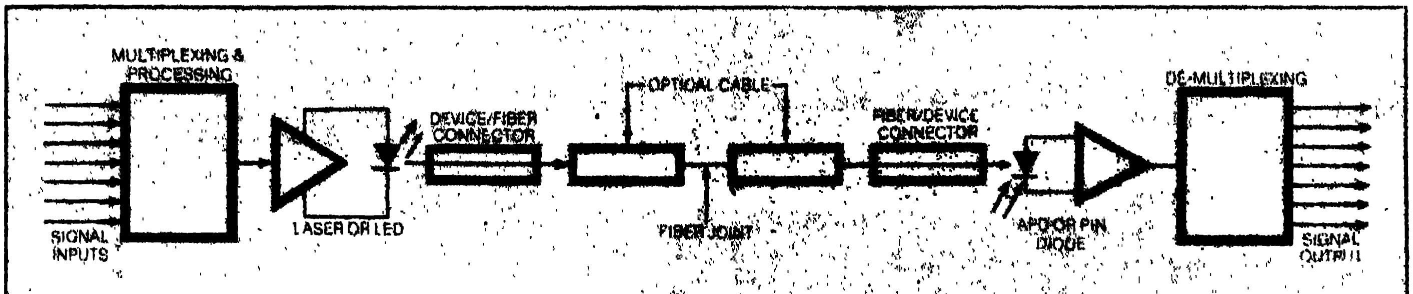

Fig.1: One-way optical fiber transmission link

delivered the first commercial cable with less than 2 dB/km attenuation, and the first commercial, single-mode optical cable. The present situation is crucial because optical fiber systems have reached an advanced stage of application and now it requires confident endorsement of the technology by the potential customers so that further improvements and refinements may be completed.

Optical fiber system

There are three basic elements of an optical-fiber communication system, namely:

(a) Source: Which converts the electrical signals into optical energy and launches the energy into the propagating medium.

(b) Optical fiber: The propagating medium, which guides the energy.

(c) Detector: Which converts received energy back into the electrical signal.

Much of the importance has been concentrated on fiber technology, but parallel development of sources and detectors is also equally important. Employing fiber optics is not a simple matter of routine assembly of a system of transmitter (source), receiver (detector) and optical waveguide fiber. In designing a system, consideration must be given to the type of data to be transmitted, i.e. data rate, cable length, number of connectors, type of sources and detectors used, etc. The power loss in the system must be determined by analysing the coupling losses at the source, connectors, along with fiber and detectors. Other factors to be considered are allowance for temperature degradation, time degradation for the light emitting diodes (LEDs) or laser sources and additional safety factors. A one-way optical fiber transmission link is shown in Fig. 1.

Optical source

A small, bright, fast and monochromatic light source is good for optical fiber systems, A small light source is efficient; brightness assures plenty of light energy to the fiber; a fast source ensures high-speed data transmission and a monochromatic source permits low dispersion in the fiber.

There are two such sources available at present; a light emitting diode (LED) and a laser. The LED is basically a pin junction where recombination of holes and electrons causes photo emission. It produces a fairly broad source bandwidth. It is a simple, cheap and reliable device (life time more than a million hours), and has linear current input/output characteristics.

The laser is a complex semiconductor device made up of precisely doped Ga As (gallium arsenide) sandwiched between layers of $Ga_{1-x}Al_xAs$, which allows lasing action in the Ga As active region that is typically 0.2 micrometre thick only (Lasing condition corresponds to the emission of predominantly coherent or stimulated radiation.) Energy is emitted from the two end faces of the device because of the nature of the lasing action of line width only 2.3 nanometers. This energy is emitted in a narrow cone, allowing high coupling efficiency. The optical power launched into the fiber is much higher than that is available from the LED source (see Fig 2) Unfortunately, the laser is not a very stable device as its output decreases with time and increase in temperature.

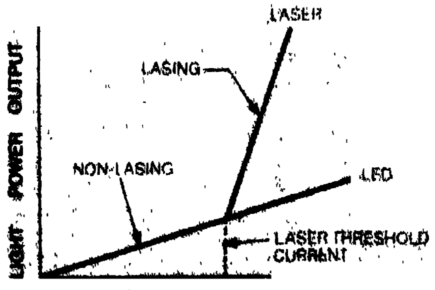

Fig.2: Graphic representation of the optical powers available from LED and laser sources

Laser diodes and LEDs are now being developed with factory-assembled fiber pigtails attached to avoid the need for field alignment of fiber to devices smaller than a grain of salt. Although lasers and LEDs differ considerably in their performance characteristics, both are based on the double heterojunction liquid phase epitaxial growth process. The emission wavelength of the devices depends upon the bandgap of the semiconductor in the recombination region of the diodes. Hence, the peak output wavelength can be varied within the range of 800 to 900 nanometers by adjusting the aluminium concentration of the semiconductor alloy. This wavelength region

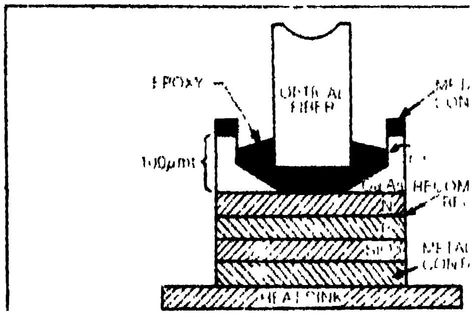

Fig.3: Physical structure of both laser and LEDs now being developed with factory-assembled fiber pigtails attached to avoid the need for field alignment of fiber to devices smaller than a grain of salt

has proved to be of interest in fiberoptic communication applications due to the availability of low-loss optical fibres (less than 5 dB/km) and the excellent spectral match with silicon photodiode detectors

The physical structure of both laser and LEDs shown in Fig 3 consists of a rectangular shaped semiconductor die in which the radiant output is emitted from the edges of the diode in the recombination region of the junction. Devices utilising this construction are called 'edge emitters'. These are well suited for use in optic fiber as the small diameter fiber core (as small as 50 micrometers) can be easily matched by making the stripe width quite narrow.

Thus the actual size of the radiating region can be matched to the size of the fiber for optimum collection efficiency. This minimises coupling loss. It is also possible to restrict the emission angle in the plane perpendicular to the plane of the junction. This is due to the waveguiding characteristics of the thin recombination layer. A curve of narrow radiation pattern is shown in Fig. 4.

The laser diode, in comparison with the LED's requires an optical cavity and a high injection carrier density. The optical cavity is usually a fabry-perot cavity formed by clearing the opposite ends of the diode to form partially reflecting optical surfaces. The optical energy launched into the fiber by laser diodes is up to 13 dB higher than that which is fed by an LED, but lasers are not very stable devices as their output decreases with time and rise in temperature. In some cases, the threshold current can increase to a level sufficient to cause

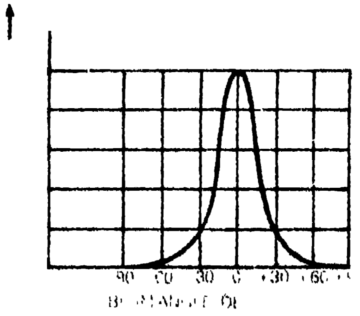

Fig.4: Emitter radiation pattern

nonlasing. Because of this strong dependence of threshold current on temperature, the laser should be operated at some fixed temperature within the operating range. Laser diodes are particularly well suited for long distance communications applications due to their very small source size (less than 15 micrometres) and their relatively narrow spectral width and radiation patterns (see Fig. 5).

Optical detectors

Photo detectors are used to convert light into electricity. Silicon PIN diode (P and N semiconductor, I-intrinsic) and avalanche photodiode (APD) are used in fiberoptics as detectors because of their broad spectral range, high response from the visible to the near infrared regions of the spectrum and fast response (greater than 1100 nanometres). They are suitable for many near infrared laser beam detection applications.

PIN photodiode: Silicon has a band gap of 1.1 ev; radiant flux having wavelengths up to about 1100 nano metres are absorbed in silicon and create electron-hole pairs. If the radiant energy is absorbed by a reverse PIN diode, the field sweep of the electron-hole pair and the resulting photocurrent can be used to develop a voltage across a load that will be proportional to the intensity of the energy.

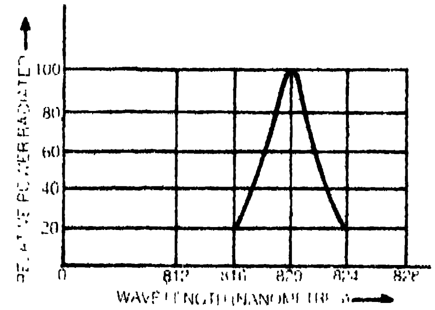

Fig.5: Emission characteristics of Ga Al As laser diode

Avalanche photodiode: The silicon avalanche photodiode is the solidstate counterpart of the photomultiplier tube. It has an internal gain mechanism due to impact ionisation, very high responsivity, high gain-bandwidth product and fast time-response chara- cteristics. The temperature-sensitive nature of these diodes suggests that the installation environment should be clearly examined. Its high signal-to-noise ratio enables use at high bit rates.

Optical fiber

This is the third essential element of the fiberoptic system — the transmission medium between the source and the detector. The principle of transmission of energy along an optical fiber can be similar to the concept of total internal reflection. Total internal reflection occurs when energy in one medium strikes a boundry of another medium of lower refractive index at greater than the cri-

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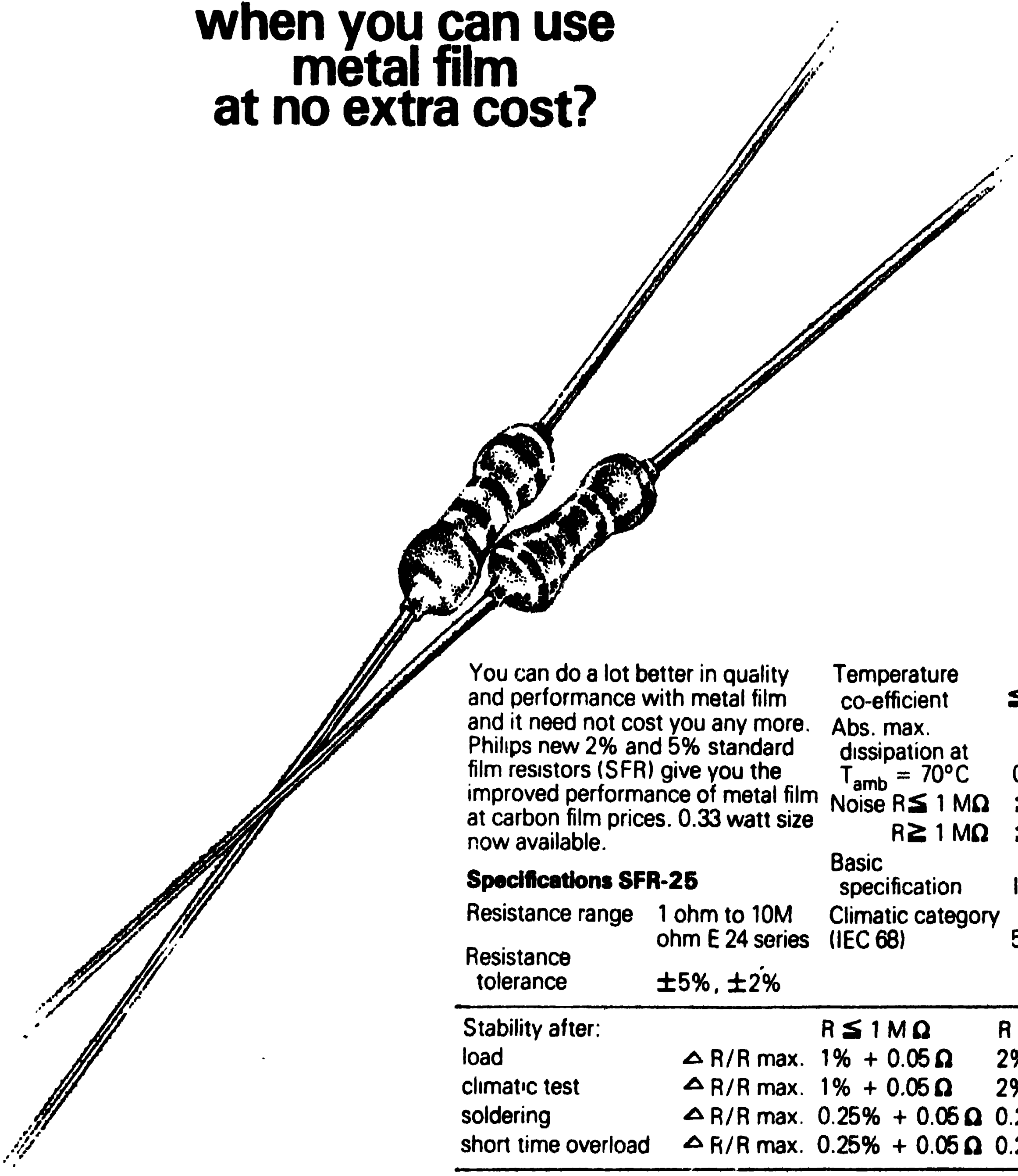

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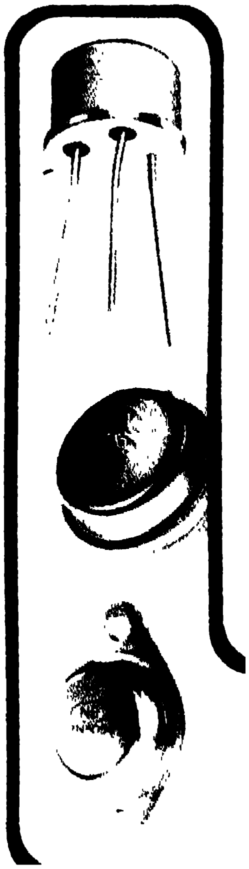

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tical angle, which is directly dependent upon the ratio of the two refractive indices.

The optical fiber cable consists of a glass core clad with a sheath of a different glass, the core having a higher refractive index than the sheath (see Fig. 6). Fiber for optical communication application must meet several conditions. It must have a very low optical scattering and absorption for low attenuation. Furthermore, the transmitted energy must be optimum, both with regard to amplitude and phase for the maximum transmission capacity.

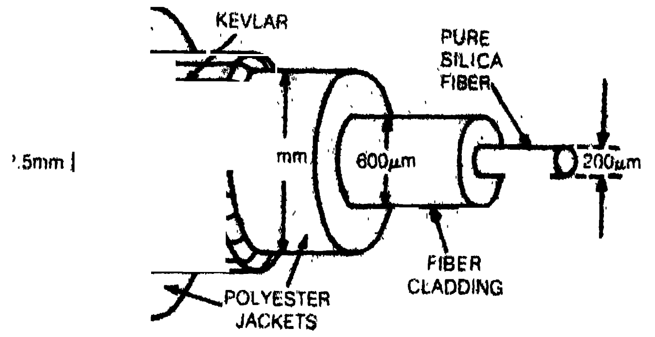


Fig. 6: Structure of optical fiber cable.

Fiberoptic currently used in electronic systems are categorised by the optical properties of the fiber and the number of fibers in the cable. For wide bandwidth and long-distance communication systems, high-quality, low-loss (less than 2 dB/km), graded-index glass fiber cables singly or in multiples are used. Fig. 7 shows the fiber attenuation vs wavelength.

For applications requiring lesser bandwidth and smaller distances, less expensive step index glass fiber cables are used. For short distances, glass and plastic fibers (greater than 100 dB/km attenuation) are used. There are trends towards the use of specific cable sizes. Single fiber sizes ranging from 100 to 125 micrometres and used for telecommunication, 250 to 300 micrometre size cables are used for computer and process control applications. Bundles of several fibers are usually 380 micrometres to 760 micrometres in cable size.

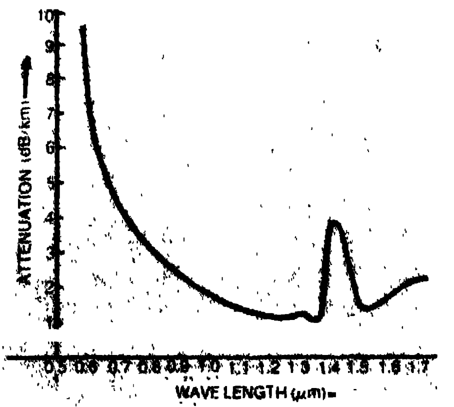
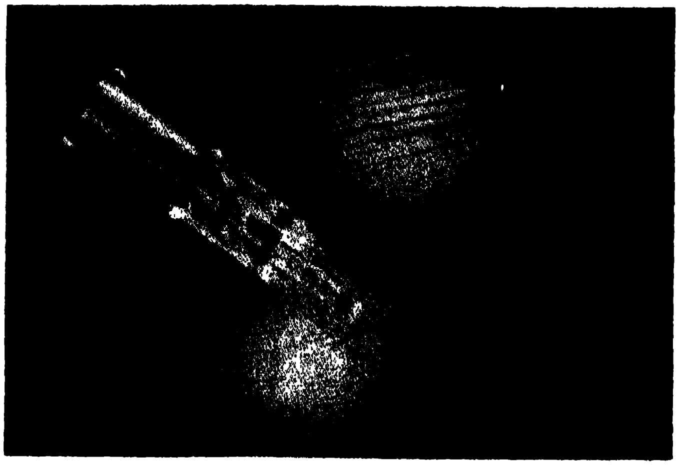


Fig. 7: Fiber attenuation vs wavelength.

Two methods are used in protecting the fiber and ruggedising the cable. The fiber can be either tightly wrapped with supporting material or can be inserted into a hollow protective tube. Both the types of construction include a strength member (Kevlar) and an environmental protective outer jacket. Fibers are generally classified in two ways; by refractive index profile (step or graded index) and by attenuation (dB/km loss). The graded index fiber is a low loss type, and the rest being step index.

(a) Step index fiber: This fiber is so called because of the rapid change in refractive index at the core-cladding boundry, giving rise to a step like profile. The refractive index remains constant from the core-centre to the core-cladding boundry. For step index fibers, the bandwidth-length product has a value of 25-30 MHz km.

(b) Monomode fiber: In this type of fiber, the core diameter is reduced to 5 to 6 micrometres to help propagation in axial mode only. This fiber helps large bandwidth signal propagation because of its low dispersion values. Bandwidth-length product can be achieved as high as 10 GHz km.



(c) Graded index fiber: In this type of fiber, the effect of modal dispersion is reduced by modifying the refractive index across the core, thus making the higher order modes travel their longer distance faster so that all modes arrive at the receiver nearly at the same time. This approach gives rise to the graded index fiber.

Today, graded index fibers are made in commercial quantities with attenuation of less than 4 dB/km to a wavelength of 850 nanometres. Attenuation of as low as 0.2 dB/km at 1.5 micrometre wavelength has been achieved, which is close to the theoretical minimum at that frequency.

Earlier the optical fiber was fabricated with the lowest attenuation at or near 850 nanometre wavelength. So it became an unofficial standard with sources and detectors specifically designed for this wavelength. Later improve-

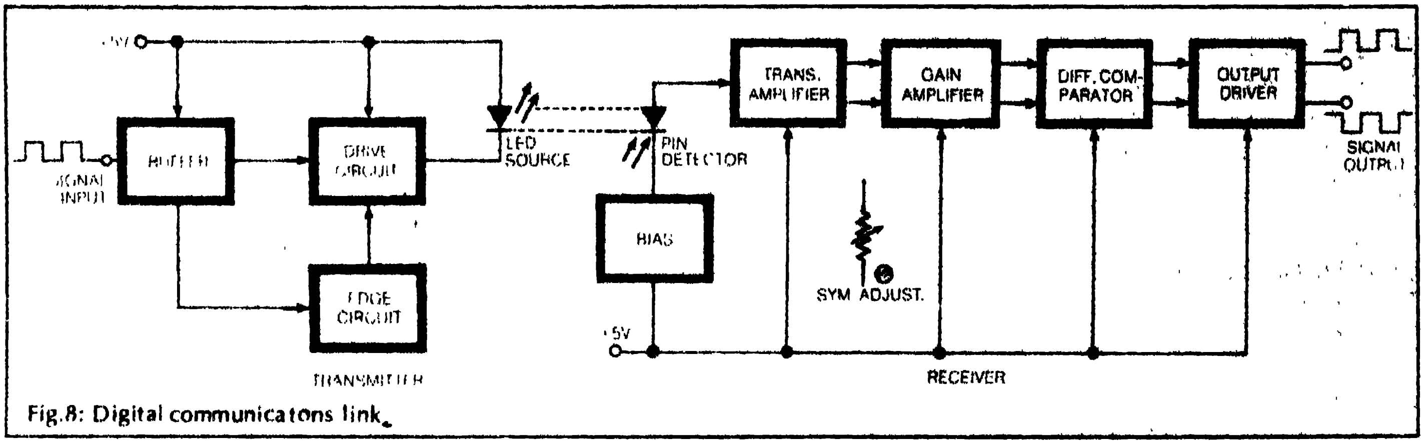


Fig.8: Digital communicatons link.

ments in low attenuation fiber at longer wavelength paved the way for development and commercial availability of sources and detectors in the 1.1. to 3 micrometres region wavelength. The Galite Inc., CT , Belden Corporation, Geneva, DuPont, Siecor Optical Cables Inc . NC., Times Fiber Communications, CT., and Veltec, MA are the fiberoptic cable suppliers

Connectors

There are two types of connectors available for connecting cable to cable or cable to device, viz, single fiber type and bundle type. Connecting fibers into terminal equipment presents the need for an optical connector which can be repeatedly reconnected and disconnected without affecting the system performance.

Because of the very small active core area in the single fiber, alignment is critical. For efficient coupling of single fiber, the end separation, axial and lateral alignment tolerances must be of the order of a few microns. Moderately careful alignment is required while terminating with a bundle fiber. The fibers are held together as a unit with epoxy, then they are grounded and polished to a smooth optical end.

AMP Incorporated's Optimate Optical Connectors are available. They are low-cost connectors designed for a number of common optical cable types with 50, 100, 200 and 300 micron core diametres. Another fiber cable connector manufacturer is Amphenol—RF operation.

Optical fiber systems

The above elements—source, detector, fiber and connectors—are combined in a conventional manner, i.e. the source being modulated by the signal and the fiber carrying the energy to the connector where it is demodulated from the high-frequency optical carrier. If the distance between source and detector is more than 10 km, one or more regenerator (similar to repeaters) is usually required. However with the low-loss fiber system, a span of 50 km can be achieved without regenerators.

Earlier developments of optical systems used pulse code modulation (PCM). But lately, there has been renewed interest in systems using analogue modulation.

The digital communication links, i.e. transmitters and receivers, are designed specifically for the fiberoptic communications. The system consists of a transmiter and a receiver each in a small compact package These systems offer the designer a choice of sensitivity and bandwidth, making them useful in a wide variety of applications which include data transmission, high voltage optically isolated data systems, computer interface, process control and instrumentation. These low-profile transmitter and receiver modules are complete functional units requiring only a standard transistor-transistor logic (TTL) data input and a common 5-volt power supply for operation at data rates to 50 megabits per second and distances in excess of 2 km.

The transmitter includes input buffering utilising standard schottky TTL gates. It uses complementary drive circuitry to reduce power supply ripple. The source is high-speed LED. A fiberoptic cable is internally coupled from the emitting region of the 'Ga Al As' chip to a 'n' optical connector.

The receiver utilises a silicon PIN photodiode with amplifier and threshold detection circuits to convert input light pulses to standard TTL electrical output signals. The receiver includes a compatible fiberoptic connector. The functional block diagram of a digital communications link is shown in Fig. 8.

But for the practical application of any fiberoptic data link, several considerations are necessary. Among them are optical loss, field adjustments, cables and connectors, electrical interfaces and mounting considerations. There are many reputed manufacturers like RCA, Optical Information Systems Inc., Litronics, Veltec Corporation etc, who supply a range of fiberoptic data links for various data transmission applications, considerating all factors such as coupling losses, field adjustments, fiber bandwidth and attenuation, data rates and mounting arrangements. While considering the optical system, the transmitter-to-fiber loss, fiber cable loss and fiber-to-receiver link loss give the fiber length calculations as shown in Fig. 9.

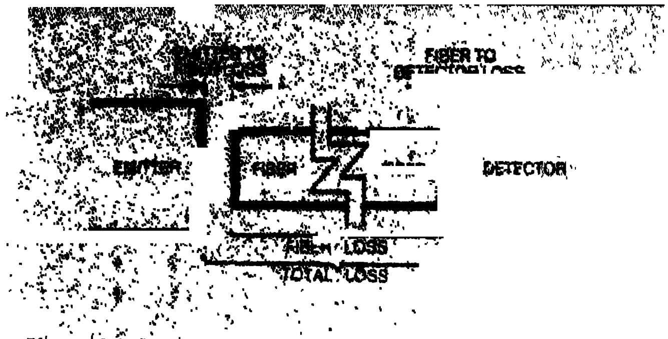


Fig.9: Total system loss

Cabling

Installation of fiber cable is practically very easy, whether it is duct laying, erected on poles, or laid directly into the ground. It has not given any breakage of cable nor it is affected by severe environmental changes.

Connector termination and alignment requires that the fiber-to-fiber interface not only be precisely aligned for minimum energy loss but spacing must be maintained within 0.25 micrometres to 0.05 micrometres to maximise coupling. In present-day connector designs, precise alignment and spacing are achieved by using the precision machined parts. These connectors are capable of being unmated and mated with no appreciable increase in dB loss, i.e less than 0.5 dB loss.

Each data channel should have its own fiber for transmission as two-way transmission on a single fiber requires additional coupling losses on input and output. Therefore, whether a number of channels are provided all in one cable or in several cables on a modular basis, it all depends on the user—keeping in view the cost, space and weight considerations.

The test equipments used for the testing of fiberoptic systems are: attenuation measuring set and time domain reflectometer (TDR) or backscatter equipment.

Design benefits and economic consideration of fiberoptic systems

Compared to the conventional coaxial cable data transmission, the fiberoptic transmission has got innumerable advantages:

1. The fiberoptics are immune to the electromagnetic interference, radio frequency interference and electromagnetic pulses. The EMI/RFI/EMP noise will not cause any damage or error to the terminal equipment.

2. The fiberoptic cable, properly coated, does not radiate the signals or pickup external signals. It is thus free from crosstalk, irrespective of the data rate.

3. The communications are very secure, as the fiberoptic cables are resistant to intrusion by breaking the cable.

4. Fibreoptics does not give any sparking or short-circuit problem; so it can be used in hazardous environments.

5. Fiberoptic cable can transfer larger information, i.e. very large bandwidth signals compared to copper wire cables. Transmission rates exceeding 1000 microbits per second are possible.

6. The fiber cable is made up of silica, the second largest source material available on earth.

7. Low-cost fiberoptic cables can run up to 5 to 10 km before repeaters are necessary. Large repeater spacing compared with metallic transmission system results in improved system reliability, lower initial cost and decreased maintenance cost.

8. The fiberoptic cables are small, lightweight and flexible compared to the coaxial cables. A weight saving of 80:1 is possible. Thus this saves in shipping and storage costs for volume users.

9. As an added attraction for the computer field, these cables are free from noise pick-up, thus avoiding hardware/software error checking and correction.

10. Fiberoptic cables solve the problems caused by crosstalk, ringing and echos.

Economic benefits

The high data rate transmission capacity means that only a fraction of the number of lines is required for the fiberoptic cables as compared to the copper cables. At present, fiberoptic cable costs about the same as a premium grade coaxial cable. With time, prices of the coaxial cable will continue to rise along with the copper prices. As the production volumes of fiberoptic cable will go up, the prices will come down. Its small size and low weight will naturally help to keep the manpower costs of installation down. Thus this saves money and also space.

Naturally, like any new system, the fiberoptic system has its own disadvantages. Being a very new system, new equipment and field practices are required. Also, testing procedures for fiber data transmission are complex unlike for the copper cables. This requires care while jointing or forming connectors, and it is not so easy to form a T joint as in a copper cable. As stated earlier, the fiber gets degraded by ionising radiation.

Future

Fiberoptics has a bright future. Since the technological development of fiberoptic communications was prompted by the telephone companies, it follows that they will be the major users of fiberoptics. An allround improvement has been achieved with fiberoptics compared to the conventional methods employed. Fiberoptics will open up new fields which have not been previously feasible.

The continuing development will minimise the other problems and pave the way for allround applications of fiberoptics. A number of field trials have been made in the USA, the UK, Europe and Japan, in which fiberoptics has proved a viable and practical data transmission carrier. It has a very promising future for those involved in telecommunications. □

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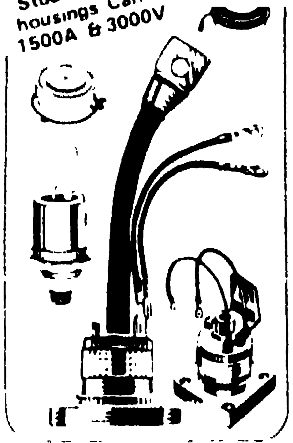

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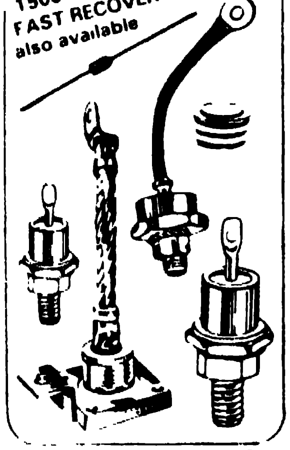

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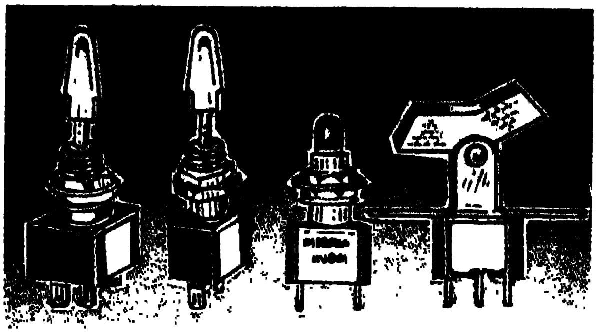

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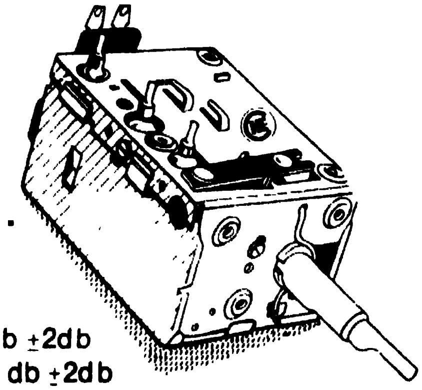

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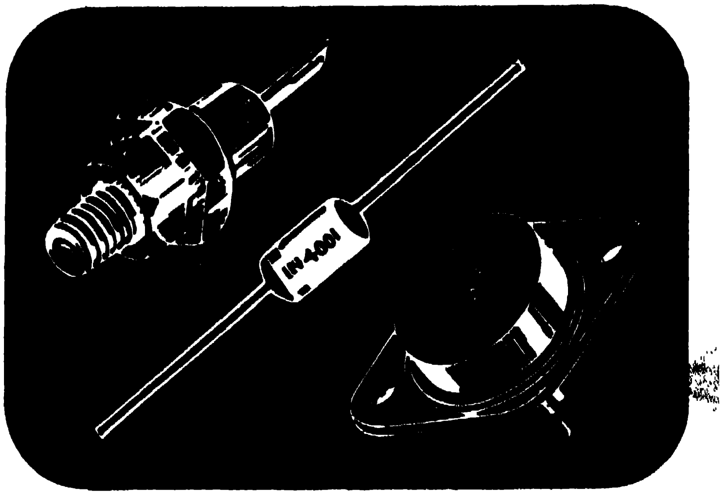

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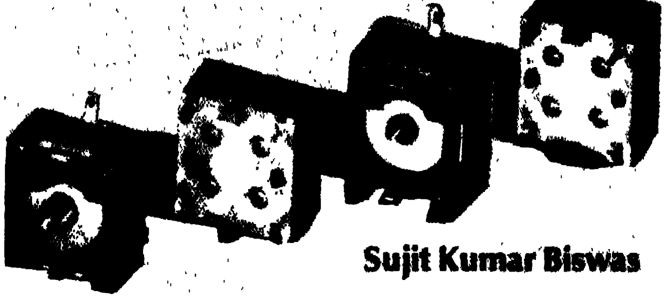

Sujit Kumar Biswas

A tuned circuit is formed by a combination of a coil and a condenser. It can select a given signal frequency from a number of different frequencies. As in the case of a radio receiver, it is necessary to be able to vary the tuning so that signals of different wavelengths or frequencies may be received. This can be achieved by varying the inductance or the capacitance of the typical tuned circuit shown in Fig.1. The latter procedure, however, is simpler and is nearly always adopted. In such circuits, the longer the wavelength of the signal we wish to select, the more capacity must be put in the tuning circuit.

Capacitors and capacity

A capacitor (or condenser) is made of two metal electrodes, separated by an insulating medium, called the dielectric material.

The property of the condenser to store electrical charge is termed as the capacitance. The capacitance of a condenser depends on its various physical and electrical parameters. The capacitance is directly proportional to: (i) the area of overlap of the electrode plates, (ii) the number of pairs of such plates in parallel, and (iii) the specific inductive capacity of the insulating material used. On the other hand, the capacitance is indirectly proportional to the distance between the plates. Capacity is usually expressed in microfarads (abbreviated as μF or mfd) or in picofarads (abbreviated as pF). A microfarad is 1/10^{6}th and a picofarad is 1/10^{12}th respectively of a Farad, which is the unit of capacitance.

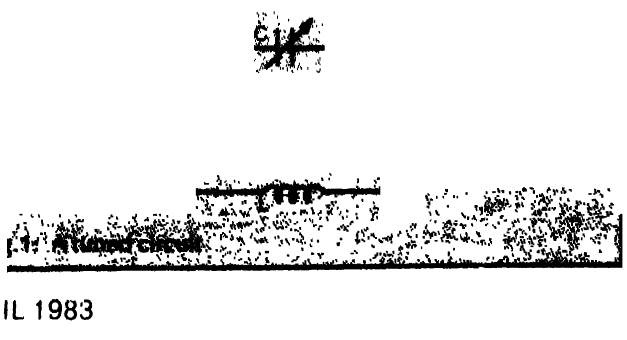

Fig. 1: A tuned circuit

There are basically two types of capacitors, viz. fixed and variable. Here we will discuss only the different forms of variable capacitors.

Variable capacitors

Variable capacitors are generally made having a fixed set of vanes while a set of moving vanes operate between the gaps of the fixed vanes. The fixed and moving vanes are mutually insulated either by air or some other dielectric material. When the vanes of the condenser are fully interleaved, we get the maximum capacitance.

Many variable condensers have an air dielectric, but others have dielectric materials like mica, polyester or other insulating materials.

The former are always more efficient because air is the most perfect dielectric material known, causing minimum energy loss. On the other hand, solid dielectrics, having a higher 'dielectric constant', require a smaller area of vanes to make a condenser of a given capacity. In addition, the vanes can be placed much nearer to obtain greater capacitance, without the least fear of a short circuit. Consequently, the physical size of a solid dielectric condenser is sizeably less than that of an air dielectric condenser of equal capacity.

Air dielectric condensers are used when precision tuning and low losses are involved. But solid dielectric condensers are suitable for compact, portable sets, where loss can be tolerated within limits.

Types of variable capacitors

The type of variable capacitor depends on the performance characteristics desired This variation in the capacitor characteristics is achieved by modifying the shape of the moving vanes. The shape of the fixed vanes is quite unimportant, provided that they are large enough to completely overlap the moving vanes when interleaved. The general types of variable capacitors are described hereafter, each having advantages for certain requirements.

Straight line capacitor: Condensers of this type have semicircular moving vanes, as shown in Fig. 2(a). As a result, the capacity increases (or decreases) at a uniform rate as the moving vanes are turned. This results in a linear relationship between the capacity of the condenser and the angular position of the dial, as shown in Fig. 2(b) In actual practice, the graph curves slightly at each end of the dial, as shown by dotted lines.

This type is suitable for applications such as reaction control (feedback control from detector stage to the tuning stage) in a wireless receiver but unsatisfactory for tuning purposes in receiver sets. This is because the wavelengths to which a coil will tune are not proportional to the capacity of the tuning condensers. Thus stations are crowded at the lower range and spaced unnecessarily at the upper range, if such a condenser is used in a radio set.

Square law capacitor: The last mentioned disadvantage caused the introduction of the 'square law' or 'straight-line wavelength' condensers. The shape of the moving vanes is such (see Fig. 3(a)), that as they are rotated, the area of overlap of the vanes is small at first and greater towards the end of rotation. This results in a linear relationship between the wavelength of the tuned circuit and the dial angular reading, as shown in Fig. 3(b).

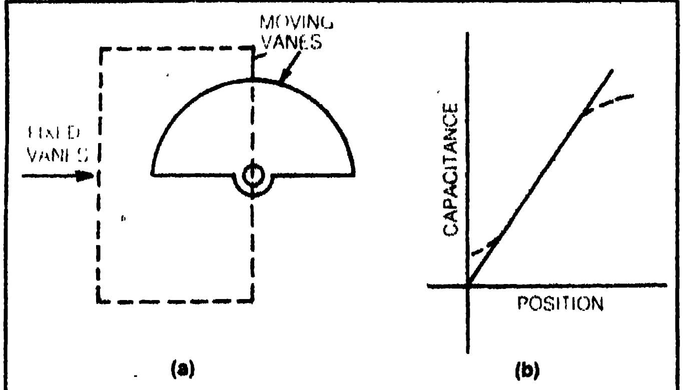

Fig.2: Straight line capacitor

This is very useful from the view of receiver calibration, but it still causes stations on the lower wavelengths to be more crowded than the ones on the upper side. This is because it is the frequency, rather than the wave length, which gives the desired spacing of stations in a radio set.

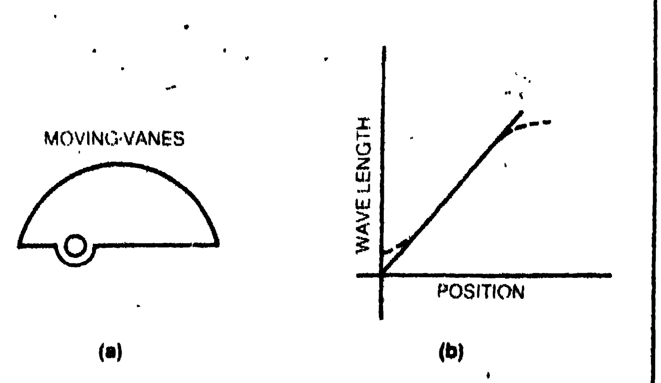

Fig.3: Square law capacitor

Straight line frequency capacitor: We can now appreciate the value of the straight line frequency condenser. The usual shape of vanes is shown in Fig. 4(a) and is so designed that the frequency of the tuned circuit is proportional to the dial angular setting, as shown in Fig. 4(b).

For many applications, this is the most convenient, since it gives equal station separation over the whole of its scale and also permits easy calibration in terms of frequencies. However, this type of condenser is not suitable for 'ganging' (physical coupling with another variable capacitor in a radio set) because of its comparatively small capacity at low dial readings. In consequence of this, stray capacitances and trimming capacitances absolutely ruin the matching except on the higher dial readings.

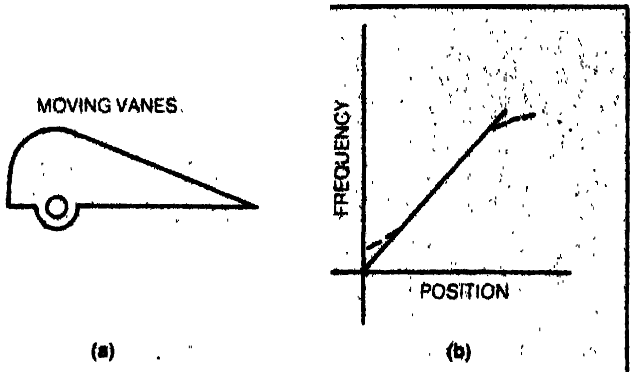

Fig.4: Straight line frequency capacitor

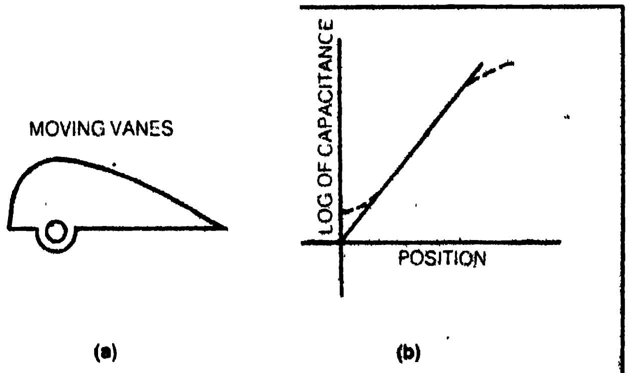

Fig.5: Log capacitor

Log capacitors: These are the best for 'ganging' purposes and their tuning characteristics lie somewhere between those of the straight line frequency and the square law capacitors. Its vane shape is shown in Fig. 5(a) and the dial reading is proportional to the logarithm of the capacity, as shown in Fig. 5(b).

Differential capacitors. These are similar to ordinary

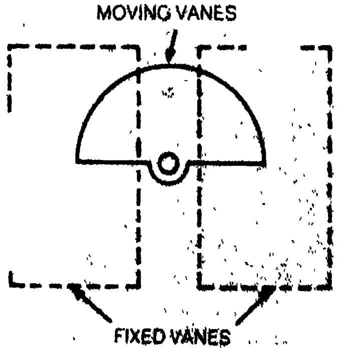

Fig.6: Differential capacitor

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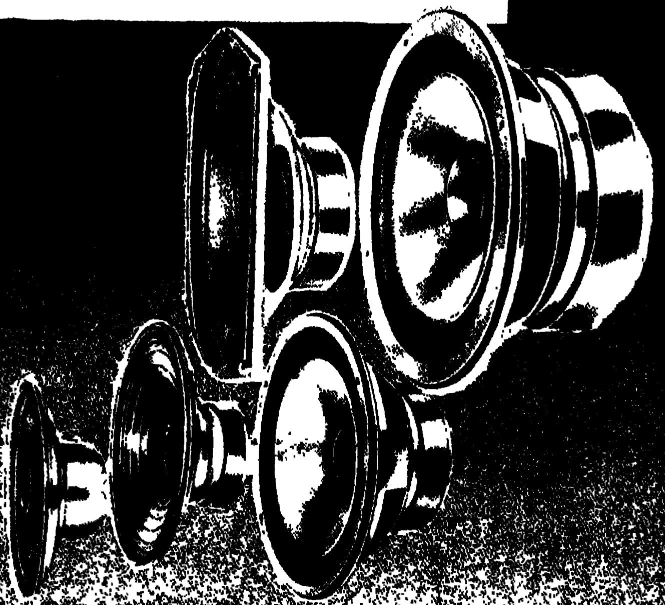

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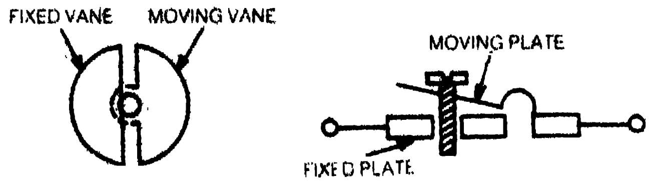
variable condensers except that they have two sets of fixed vanes and one set of moving vanes. The latter can mesh with either set of fixed vanes and usually are partly in mesh with both, as shown in Fig. 6. These are always of the straight line capacitance type, so that the sum of the capacitances between the moving and both sets of fixed-vanes remain constant. As the capacity is increased on one side, it is decreased on the other side at the same rate.

These are often employed for 'reaction control' purposes in radio sets.

Trimmer capacitors. These are variable capacitors of small values and range, which can be preset to a given value by suitable adjustments and are not meant for continuous variations.

Trimmers are connected in parallel with each section of 'gang' condensers, so that they can be matched to compensate for the individual stray capacitances. There are a number of different ways of making them, but the two principal methods are shown in Fig. 7(a) and (b).

In Fig. 7(a), the moving and fixed vanes are semicircular, and the moving vanes can be brought to mesh with the fixed vanes by turning the screw to the required degree, thus increasing the capacitance. In Fig. 7(b), the tightening of the insulated screw brings the springy plate closer to the fixed plate, over the mica dielectric, increasing the capacitance. The plates here are usually rectangular.



(a) (b)

Fig.7: Trimmer capacitors

Split end-plate condenser: This is just a different method of trimming gang condensers. In this case, the end moving vane of each section is split radially and is set further away from the next fixed vane, than the others, as shown in Fig. 8. Thus the capacity of any condenser section of this end plate can be adjusted at any part of the dial by pressing the appropriate sector of the split vane towards the adjacent fixed ones. These types of 'gang' condensers can be matched with perfect accuracy over the entire tuning range.

Requirements of variable condensers

Variable capacitors are subjected to continuous adjustments, involving movement of the vanes. Thus, a rigid structure is a must for all variable capacitors so that the capacitance is not changed by bending of the vanes. The spindles should also be stiff and well mounted, preferably with ball bearings, so that radial displacement does not take place.

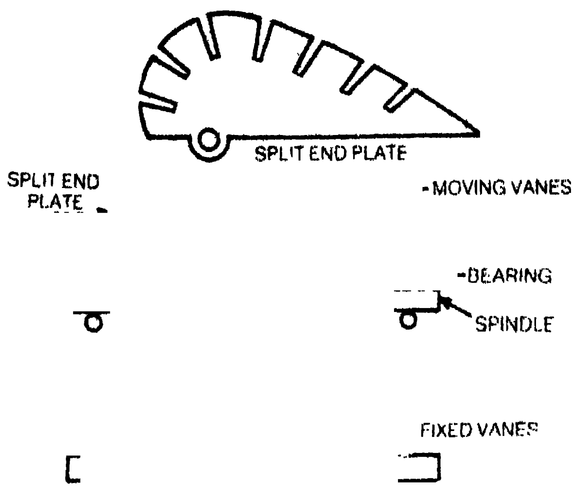


Fig.8: Split-end plate capacitor

A careful design is necessary so that the minimum capacity of all variable capacitors is as low as possible for any given maximum capacity. Insulation must be proper to minimise the leakage loss. And finally, the capacitor must have excellent reproduction of its capacitance at a particular setting, irrespective of the number of position changes its moving vanes has gone through. ☐

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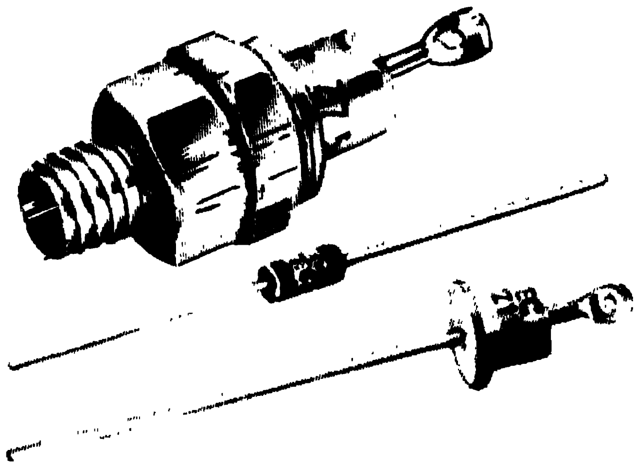
Zener Principles Revisited

(PART - I)

A.V. Jacob



The boundaries of electronics are continuously expanding due to the revolutionary conceptualisation and fabrication of electronic devices. The province of 'device-and-circuits' did not surrender to the explosive flare-up of integrated circuits, which started in the early 1960's. Even though among the jungle of integrated circuits discrete components got reduced to a mere blemish, which spoilt the beauty of the PCB layout, nobody could question their capabilities in protecting the organised jungle. Discrete transistors and diodes still enjoy superiority in the functioning of most silicon marvels. In recent years emphasis has been almost completely on the development of the semiconductor diodes.

More than a dozen semiconductor diodes have come to the fore in the last few decades. Of these rectifier diodes including detectors, zener diodes and LEDs are ubiquitous. The development of discrete devices, such as transistors and diodes and their associated technology, did not come about overnight. Much research by many companies and institutions was needed for more than three long decades and millions of dollars were spent. But through many decades the pace of technological progress changed dramatically. The integration of several existing technologies paved the way for an envisioned chaos. Many of the discrete components had ceremonial burials in the substrates of integrated circuits. Fortunately, the life and times of such devices could be investigated without formal exhumation.

Zener diode is not a babe in electronics. In the first half of the 1950's zener devices entered into the world of silicon marvels just as a condiment amongst transistors, resistors and capacitors. By its very nature a zener diode looked like an ultramodern device, and hence designers who wanted to move with the times were too eager to go in for it. The concept of zener breakdown seemed a harebrained idea at first, but then it proved that it could revolutionise "Electronics under the Sun." Now the zener kingdom is spread from the discrete components to VLSI, and it continues to expand to each and every possible nook and corner of electronics. Present-day electronics can survive without zeners, but cannot flourish. In popularity, zener devices are second only to transistors. If properly designed, one can install a zener device in a circuit and forget it.

The story of zeners began as early as in 1934, much before the deluge of discrete semiconductor devices. Dr Clarence Zener, an American physicist, predicted the possible breakdown mechanism (see box) in dielectrics or insulators. Later when semiconductor junction diodes were fabricated and used, three possible breakdown mechanisms were observed and one of them was exactly what Zener had predicted. The remaining mechanisms, Avalanche and Tunnel, are also extensively observed in junction diodes under suitable doping concentrations and applied potentials. Diodes rooted from these three breakdown conditions are available worldwide. Modern zener diodes are as wrongly named as they are unfairly treated. If a device has to be named after the innovater it should be 'zeners' below 4 volts and 'avalanche' above 8 volts rather than only zeners, because most of the zeners are produced to operate in the avalanche region, which has an altogether different breakdown mechanism.

The quintessential zener breakdown occures only below 4 volts of reverse bias while avalanche takes place above 8 volts of reverse bias, and both these are present between 4 and 8 volts. Nowadays, the zener and avalanche mechanisms are collectively known as 'zeners', even though their modes of operation are essentially dissimilar. This quizzical situation was forced on the consumer by the electronics *pundits* in the early 1950's. The vague outlines of compromise do exist in the imbroglio.

Zener parameters

The critical parameters of a zener diode in practical designs could be defined with the help of an ideal zener model. A simple but workable zener model is a combination of a battery of voltage V_Z connected in series with a resistor R_Z. A current I_Z flows opposite to the direction of V_Z. For a given family of zener diodes, principally three fundamental parameters decide the nature of its function (see Fig. 1). They are V_Z, R_Z, and I_Z. The derived supplementary parameters are: power capability, operating temperature, temperature coefficient, noise factor, peak inverse voltage, junction capacitance and package.

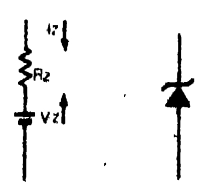
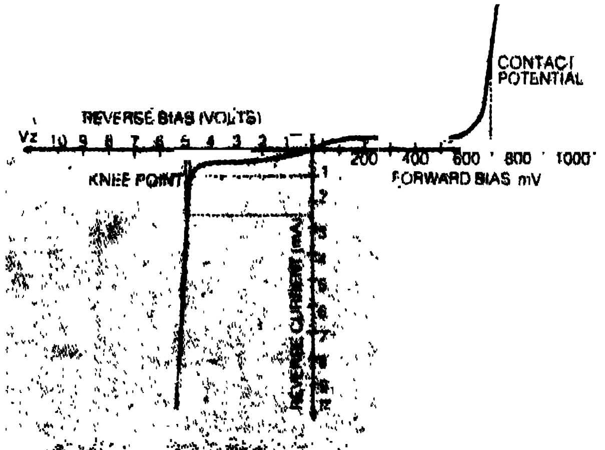


Fig. 1: Ideal Zener Diode.

Zener breakdown voltage, better known as 'zener voltage', ranges from 3.3 volts to 200 volts. The preferred values are 3.3, 4.7, 5.1, 6.2, 9.1, 10, 11, 12, 13, 15, up to 200 volts. These voltages could be increased in steps of 'contact potentials' of germanium or silicon diodes (0.3V and 0.6V), by connecting in series with the zener devices. For special applications there are high-voltage zeners which are tailored according to the needs of the specific problem. Just like resistors, zeners are also tattooed along with its tolerance. A near zero per cent of 20% tolerance levels are normally found in the market. As a standard norm, with no suffix on the device type, tolerance level is 20%, a letter A is added for 10% and letter B means 5%. However, this is not a hard and fast rule. There are different standards accepted by various manufacturers. Tight tolerance zeners with 1% to 3% are also available in the market. Moreover, data sheets specifications do not necessarily always show the same characteristics for the similar type of zener devices.



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Zener impedance R_Z and zener current I_Z are interrelated (Fig. 2(a)), simply because reverse breakdown voltage is not totally independent of zener current. However, the steepness of the zener region depends on the doping at the time of manufacture. The resistance in this region falls to a very low and constant value. It implies that when a zener diode is operating in the breakdown region, a small increase in voltage will produce a large increase in current. Indeed, zener impedance increases with the increase in breakdown voltage. A 12-volt zener 1N4057 has an impedance of 25 ohm, a 75-volt zener 1N4073 has 250-ohm while 1N4085, a 200-volt zener has 1350-ohm at a specified current level. The maximum occurs at the 'knee current'. Below the knee current dynamic impedance shoots into a very high value. Zener impedance is an influential factor in voltage reference circuits.

In the majority of the zener devices in order to operate over its knee voltage or in its well defined region of operation a current of about 1 mA must be applied through the device. The maximum permissible value of zener current is always restricted using a resistor in series with the zener. It is safe to use the zener in its recommended current range. An easier and popular term 'power rating' is more expressive because it is the product of zener breakdown voltage and maximum zener current. Commonly available power ratings are 400mW, 1W, 3W, 10W and 50W. Other power ratings are also available for specially tailored devices. As in the case of any electronic component, a safety margin of 25% to 50% is generally adopted to avoid possible high drain complications.

Power derating with ambient temperature, a common weakness with the majority of semiconductor devices, is perhaps maximum in the case of zener diodes. For example, a 250mW, 5% tolerance zener 1N4099 has a derating factor of 1.44mW/°C. This zener can dissipate 250 mW at 25°C, 200mW at 50°C and 125 mW at 100°C. In power devices, package and related heatsink designs are adequately pertinacious. Zener diodes are available in different packages such as light-weight (0.2 gm) hermetically sealed rugged all-glass case to heavy (30 gm and above) screw-cap types. Heatsink facilities are provided in high-wattage zener to encounter the heavy derating factors. Usually low-wattage (25W) soldering irons are preferred and soldering should be done very quickly, even though they have a rated soldering time of 60 to 90 seconds. In case the terminals need to be bent, a distance of 5 mm

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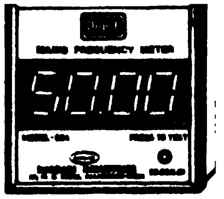

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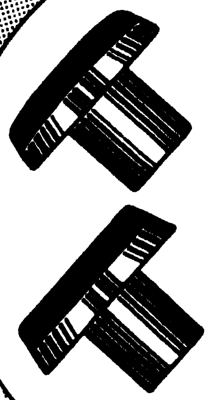

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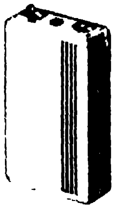

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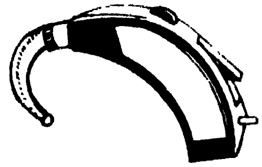

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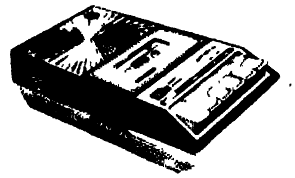

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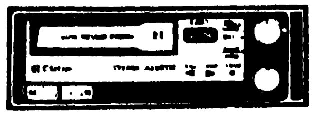

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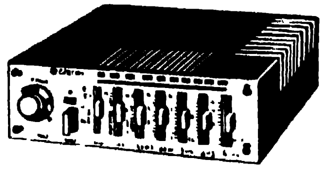

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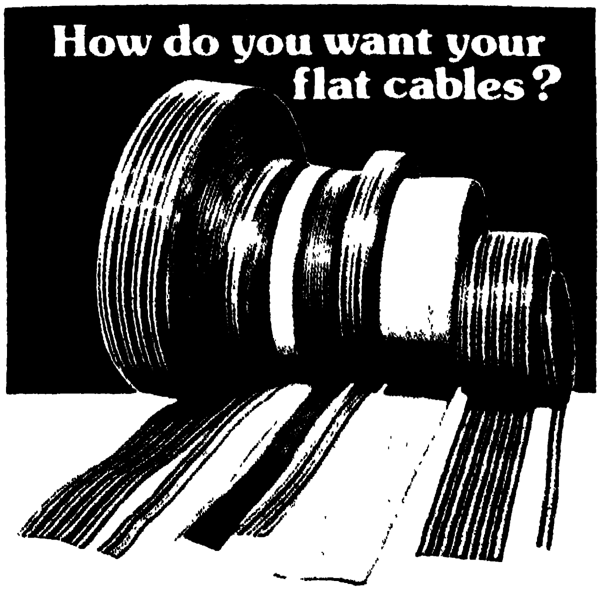

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Low-power zeners are available either in hermetically sealed cases of metal and glass or in plastic encapsulation. The former work better at higher temperatures and are reliable in severe environmental conditions. Plastic devices, which are historically unrelaible, have been drastically improved in recent years. They have remarkable reliability when operated in their specified conditions and are usually less expensive than the hermetically sealed devices.

Zener diodes, like any other diode, do possess a forward breakdown too! This parameter varies from device to device within a range of 100 to 1000 volts. A viable arrangement for only forward biased end results may be problematic because of the existence of negatively biased breakdown voltage. However, a controlled forward biasing is not at all destructive.

Junction capacitance, which yields no useful results in zener diodes, regulates the speed parameter in its switching operations. Typically, it varies from 20 to 700 pF. For any family of zener diodes, junction capacitance decreases with the increase in reverse voltage because of the expansion of 'depletion region'. For example, a 3.9-volt zener may exhibit a junction capacitance of 500 pF while the capacitance is 10 pF in a 100-volt zener diode. Temperature is one of the factors which helps fluctuate the junction capacitance in zener devices

Thermal dependence of zener and avalanche mechanisms are opposite in nature. Avalanche breakdown, which occurs above 8 volts, increases with temperature while zener breakdown voltage decreases with temperature. Between the pure zener and pure avalanche types of breakdown there is a region in which temperature coefficient is zero. Zener diodes with reverse breakdown around 6 volts exhibit this characteristic. The majority of buried zener diodes in integrated circuits have selected a breakdown voltage closer to the zero region of the temperature coefficient. Temperature-compensated discrete zener diodes are made by exploiting the differing thermal characteristics of forward and reverse biased junctions. A forward biased junction has a negative temperature coefficient of approximately 2mV/°C and reverse biased junction up to 5 volts has a positive temperature coefficient of same amount.

Because of the overlapping of the characteristics of zener devices, temperature coefficient takes a near zero level at a definite optimisation point. If this current is maintained by a well-regulated constant source, thermal drift could be eliminated. An ordinary rectifier diode biased in forward direction connected in series with a reverse biased zener also can neutralise the temperature drift to a considerable extent. Often a well-defined cluster of forward and reverse biased junctions results in a highly reliable drift-free zener reference (Fig. 2(b)).

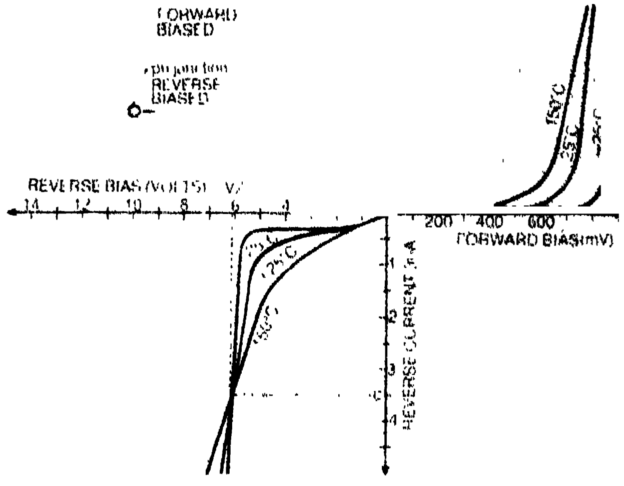

Fig. 2(b): Temperature compensated zeners.

Zener noise

Zener devices generate noise when they are biased in the zener range. It is classified into 'microplasma noise' or 'white noise' which usually emerge with constant amplitude up to a frequency range of 200 kHz, and 'resistive noise' due to the internal resistance associated with the device. For zener diodes,total noise density exceeds 250 microamperes.

Microplasma noise is the major constituent of zener noise density. This is closely related to zener breakdown phenomenon. Since zener devices are doped heavily, the electric field across the depletion region is very intense, of the order of 300k volts cm $^{-1}$. This can disrupt the bonding pattern within the atom and generate carriers in excess. Under the reverse bias conditions, charge carriers could be drawn through a narrow depletion region

TABLE I

Variation of Temperature Coefficient, Impedance and Knee Current of JEDEC Registered Zeners

Type	*Zener Voltage Z_z volts*	*I_{zt} mA*	*Z_{zt} Ohm*	*dV Volts 25°C to 100°C*
1N 4057	12.4	10	25	0.047
1N 4059	16.8	10	30	0.063
1N 4061	21.0	10	35	0.082
1N 4064	30.0	10	50	0.113
1N 4066	37.0	7.5	80	0.139
1N 4069	51	7.5	110	0.191
1N 4071	62	7.5	135	0.232
1N 4074	82	5.0	270	0.307
1N 4078	105	2.5	700	0.394
1N 4081	130	2.5	840	0.488
1N 4083	150	2.5	1020	0.563
1N 4085	200	2.5	1350	0.750

without chaotic collision between charge carriers and molecules. Under this tunnelling process a constant amplitude noise voltage of many different frequencies are generated. Indeed, noise density increases sharply as the current increases. Typically, noise density is around 35 microvolt per square root cycle at 50 microamperes and comes down to 10 microvolts at 0.5 mA (for 1N4115)

The 'resistive' type zener noise is similar to thermal noise. Conduction band electrons, which are loosely held by the atoms tend to move randomly in different directions, colliding with other atoms in the structure. The resulting noise has a wide spectrum. The amount of noise produced is dictated by temperature, bandwidth of the system and the size of the zener device. Normally, this type of noise voltage increases with temperature, bandwidth and zener resistance. Zener noise density is specified and the bandwidth, junction temperature, and the current level at which the system is operating.

Elimination or reduction of zener noise at lower frequencies can be done by a properly selected filter capacitor. However, in many applications, this method may result in the degradation of voltage regulating properties. Moreover, zener capacitance decreases as the zener voltage increases. High-voltage zener bridle the propagation delay than the lazy low-voltage conglomeration.

Under the biased conditions any junction can be re-

The Zener Story

The innovations of an American Physicist Clarence Melvin Zener on the behavior of the dielectrics subjected to high voltage were first cited in the Proceedings of the Royal Society of London. According to his theory, the breakdown in dielectrics is asociated with the inter-band transitions induced by very large fields (10^6V cm^{-1}). In these high fields electrons could be disrupted from the valence band and raised to the conduction band. This process is fairly fast enough to produce a large breakdown current. Zener's "theory of dielectric breakdown" did not hint at any immediate practical possibilities in the dormant world of semiconductor technology. Even Zener could not have fully appreciated the relevance of his investigations to the Silicon world.

During the late 1930's and early 1940's, silicon and germanium received a great deal of attention for the fabrication of contact diodes. By this time the effect of impurities, which deteremined the electrical behavior of semiconductors, was understood without much ambiguity. Techniques to grow single crystals of silicon and germanium had also reached near perfection. Before long, p-n junction diodes and transistors came into existence. Amazingly, the phenomenon of breakdown currents was observed in the p-n junction diodes too! This resul[illegible] in the generation of a new class of [illegible]iconductor devices called 'zener diodes'. In the early 1950's production of zener diodes matched the production of transistors. Zener devices won wide acceptance among consumers, mainly because of their ability to excel over the giant cold cathode gas-filled voltage regulator tubes. To top it all, just as today, miniaturisation become a primary criterion of electronic devices.

In the year 1958, breakdown mechanisms in the p-n junctions gave a complete and clear-cut picture, by the prediction of the tunneling effect in the germanium p-n junction by Dr Leo Esaki, a reputed member of a small research group at the Sony Corporation, Tokyo. Another mechanism, called avalanche breakdown, was also observed in p-n junctions. This showed that there are three possible mechanisms in the breakdown of p-n junctions, viz, zener or field emission, avalanche and tunneling mechanisms. Zener effect is predominant below 5 volts while avalanche takes over above 8 volts, and both these effects are present between 5 and 8 volts. Incidently, a majority of the present-day zener devices have breakdown voltages exceeding 8 volts. Since zener diodes include avalanche and zener breakdown mechanisms in various voltage levels, their christening was only historical — not functional. Critics got the bone of contention; zener diodes are a technical misnomer. Indeed, Clarence Zener is not only a genius, but also very lucky!

Born on December 1, 1904, Zener hails from Indianapolis, America. He was educated in Stanford University and finished his Ph. D from Harvard University in Physics. The majority of his innovative works were completed while he was in Bristol University, England. Later he taught Physics in Washington University and City college of New York. During the peak of the Second World War he joined the University of Chicago as a Professor of Physics. After the War he accepted the associate directorship of research laboratories in Westinghouse Electric Corporation. In the late 1960's Carnegie-Mellon University, Pitsburg, accepted him as the professor of Physics. He is a reputed member of National Academy of Science of the U.S. Within this span, Zener received numerous covetable awards in Theoretical Physics and Engineering.

Before Zener

Long before the advent of zener diodes there was a group of electronic dinosaurs called 'cold cathode gas filled voltage regulator tubes'. These are filled with inert gases such as neon at proper pressure. A constant voltage drop is developed across the tube when the gas is ionised. The property of VR tubes, which is used to regulate the voltage across the load, made them superior among their contemporary devices used for the similar purposes.

Anode of a VR tube is a thin wire at the centre of a metallic concentric cylindrical anode of very large area. If the tube gets sufficient starting voltage, a discharge will first occur on a small area of the cathode, and as the terminal voltage is increased this area grows larger, permitting more current to flow with very little increase in its terminal voltage. A current of 5 mA is required to keep the gas ionised properly, It can, however, draw currents up to 40 mA. If the DC potential across the VR tube is reversed, less current will flow through the tube, although it can regulate small load currents. In some VR tubes the anode is painted with a radioactive substance for better ionisation. If the envelope is broken it poses potential health hazards too !

Break up of Breakdown

A p-n junction diode is a combination of p-type and n-type semiconductors. On one side there are positively charged carriers called

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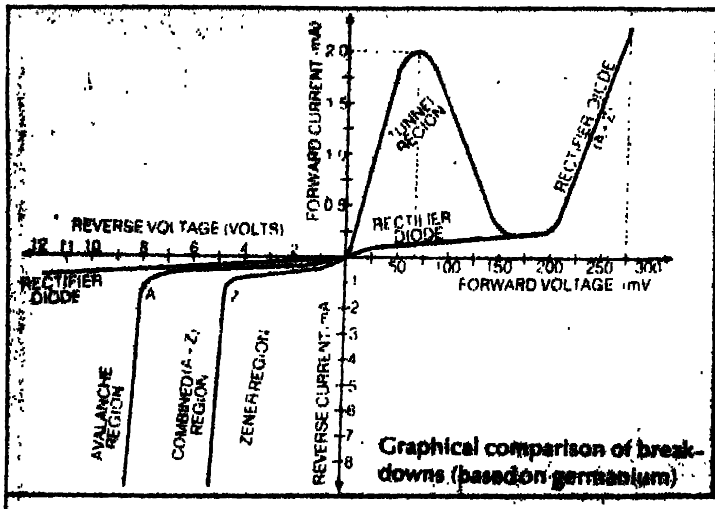

Graphical comparison of breakdowns (basedon germanium)

General Comparison of Breakdowns

Parameter	Avalanche	Zener	Tunnel	Unit
Thickness of dep. region	10^{-6}	10^{-7}	10^{-8}	cm
Impurity concentration	10^{20}	10^{22}	10^{24}	atomcm $^{-3}$
Breakdown voltage	above 8	below 5	below 0.1	volts
Temp. Coefficient	positive	negative	stable	
Bias	reverse	reverse	forward	
Frequency	1M	100K	50G	Hz
Max.current	200	3000	10	mA
Max. junction capacitance	25	200	10	pF
Max. power	100	50	0.01	watts

'holes' and on the other side negatively charged carriers or electrons. The boundary between these two regions is called a p-n junction. The junction is demarcated by a neutral region called depletion region. The net flow of charge in any one direction with no applied EMF is zero. If the n region is negatively biased with respect to the p region, current will flow because of the motion of electrons from n region into the p region and holes from the p region to the n region. If the voltage is reversed, electrons and holes will be pulled away from the junction area, resulting in a very high opposition to the flow of current.

Even if the internal current is composed of both electrons and holes, the external current is constituted by electrons only, since external conductors have only electrons for electrical conduction. Whether the semiconductor is intrinsic or extrinsic, every electron detachment from the bond leaves a hole or electron vacancy in the valence level. Since free electrons and holes are simultaneously created at the destruction of the bond, it is referred to as the generation of electron-hole pairs.

Avalanche breakdown

As the reverse applied voltage becomes larger, thermally generated electrons in the junction region are accelerated towards their opposite polarity of the applied voltage. These are normal leakage currents in any diode. A[illegible]y move through the junction, they collide [illegible]n other atoms and dislodge outermost electrons of the atoms of the rystal structure. The newly liberated lectron can then gain high velocity [illegible] the increased reverse [illegible] free other valence electrons. The [illegible]tion of electron-hole pairs is just like a chain reaction, and it is called 'carrier multiplication'. The whole process escalates to a point at which there is a rapid transition from a reverse blocking state to a negative conduction state. The production of free electrons is like the sliding of a mass of detached snow suddenly down a slope, thus the name 'avalanche breakdown'.

Avalanche breakdown occurs usually beyond 8 volts, and it depends upon the concentration of charge carriers. Avalanche breakdown voltage increases as the temperature increases. This is because of the amplitude of atomic vibration fixed in their lattice increases with temperature. The increased lattice vibration shortens the distance the carrier traverses before hitting the atom on its path. Obviously, a reduction in momentum follows the increased lattice vibration. Particles with insufficient momentum cannot initiate avalanche phenomenon. Hence voltage has to be raised to produce a mean momentum just enough to create an avalanche of electron-hole pairs.

Zener breakdown

A strong electric field in the region of the junction also can disrupt the bonding forces within the atoms and generate carriers. Since the depletion region is of the order of a few micrometres, the application of low reverse bias across the depletion region will produce a field of the order of 10^{6}V cm^{-1}. This field is high enough to separate valence electrons from their nuclei. Enormous amounts of electron-hole pairs are produced prior to the breakdown. This type of breakdown is called zener breakdown and is present below 5 volts.

The value of zener breakdown voltage decreases as the junction temperature increases. Valence electrons of the atoms in the crystal lattice acquire more energy by the increase in junction temperature. This weakens the bond pattern, resulting in the reduction of breakdown voltage.

Tunnel effect

Tunnel effect was first predicted by Dr Leo Esaki in 1958. This effect takes place in a p-n junction diode which is doped until it reaches the limit of solubility of the impurities in the semiconductor material. In this heavily doped condition the depletion region reaches the level of a few fractions of a micrometre Under a nominal external voltage, charge carriers attain sufficient energy to tunnel their way through the barrier. The velocity with which the carrier tunnels through the junction is comparable to that of light. Hence frequency characteristics are extremely high. Since the tunnel effect occurs at very low voltage, normally less than 100 mV, tunnel devices have very little power consumption. On further increase in the forward bias, tunnel diode behaves like an ordinary diode.

The White and Pink Show Off

Noise, a potential 'electromagnetic weed', is the unwanted amplitude variations of the required signal in any electronic circuit. It is unwanted simply because it always menacingly interferes with the reception, transmission or processing of the desired signals. Thermal agitation of electrons, atomic activity, solar flares, ignition systems, to name a few, are the accused perpetrators behind the [illegible] amongst the circuit designers.

White noise has a complex waveform. It is found over a broad but well defined bandwidth. Theoretically, it can be constituted from all the probable frequencies up to infinity. The power density of the spectral domain is almost constant. So it has equal energy in each and every frequency domain. White noise is equally spread in the audible range too! It is just like a beam of light, composed of different colours, visible to the human eye. It may help to produce 'snow' on the picture tube, but its name has an altogether different root.

Pink noise also has many of the white noise properties. The major difference is that it contains equal energy levels in each octave of its spectral domain. The characteristic frequency ratio corresponding to the octave interval is two, each next higher octave possesses twice the number of discrete frequencies below it. Since the pink noise has to acquire equal amounts of energy in each and every octave of its spectrum, the low frequency components of pink noise have higher amplitude than high frequency domains.

Noise is often quoted in terms of signal-to-noise ratio, abbreviated as S/N. However, other units, such as volts per square root of frequency, are also popular. S/N is the ratio of the signal power to the noise power. If the signal power is 100 times the noise power, then S/N is 100. Higher the S/N, better the device.

'Noise figure' or 'NF' is another parameter used to specify the immunity of a device to the noise. For any electronic device NF is the ratio of a input S/N to the output S/N; and is usually expressed in decibels (dB). NF tends to be unity if the device does not add any noise to the desired input signal. A higher NF of a device is an indication of its weakness in protecting the desired signal from the expected assault of noise voltage.

garded as a parallel plate capacitance. This parasitic capacitance, better known as 'transition capacitance', is related inversely as the width of the depletion region. An external capacitance parallel to the zener increases the capacitance effectively, which in turn decreases the resonant frequency of the circuit.

The diac controversy

The 'diac' a bijunction, negative resistance pnp triggering device, appeared in the market with an unfortunate and misleading symbol, that has no resemblance to the actual functions of the device. The unfortunate symbol was a combination of two back-to-back zener diodes. Later it changed to another confusing symbol (Fig. 3(b)) which directly hints at a parallel combination of diodes. However, the symbol shown in Fig. 3 (c) is gaining popularity and is more meaningful since diac consists of two junctions which are heavily and equally doped to project a mirror image breakdown characteristics. Its structure is essentially that of a transistor. The device blocks the flow of current for both forward and reverse voltages up to the breakover voltage V_{bo}. On further increase in current, the diac exhibits a negative resistance region.

Zener nomenclature

More than 600 types of zener diodes have been registered with the Joint Electron Device Engineering Council (JEDEC), and a few thousand have been marketed under the manufacturers' type number. It would be a Herculian task to bring all the zener devices manufactured and marketed by different agencies into a single volume. In India itself more than 15 manufacturers are in the field. Few of them follow JEDEC specification, and the rest are adherent to Continental nomenclature in addition to their own house numbers.

According to JEDEC designation, all semiconductor diodes are identified by the prefix 1N, which hints at the number of junctions involved in the function of the device, followed by a sequence number. Well over a thousand semiconductor diodes have been specified by JEDEC and 60% of them are zeners. About 200 zener devices have an associated temperature compensation, the remaining zeners are meant for general purposes.

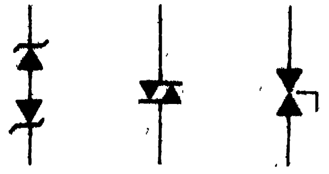
(a) (b) (c)

Fig. 3

Continental systems had adopted a collection of two letters followed by a serial number. Usually B or C will appear as the first letter, in which the former represents silicon based devices and the latter stands for gallium based devices. The second letter is Z, indicating that the device is a zener diode. The numbers may represent the type of application. A version letter, which usually appears at the end, is used to designate the tolerance. In addition to that the letter R indicates the reversal of polarity in the configuration of the device. The normal

TABLE II

Zener Noise Density

Type	*Centre Freq. K Hz*	*Zener Current mA*	*Noise Voltage Microvolt rms*
1N 821	20	7.5	0.1
	200	7.5	0.9
1N 935	20	7.5	8.0
	200	7.5	18
1N 941	20	7.5	43
	200	7.5	25
1N 2620	20	10	24
	200	10	20
1N 3154	20	10	1.0
	200	10	2.8

JEDEC registered data; bandwidth 500 Hz.

polarity is considered to be the connection of cathode to the case of the device. Polarity band or notch indicates the position of the cathode.

The old semiconductor nomenclature usually bears a OAZ followed by a serial number, where O means that the device is a semiconductor, A stands for a diode and Z indicates a zener. This system is almost obselete by the advent of JEDEC and Continental systems of nomenclature.

Principal designations for zener devices amongst Indian manufacturers are FZ, 1Z, 3Z (EC), CMZ, CBZ, CAZ, CZ, CV (CDIL), SZ (Semiconductors), HZ (Hindustan), ZM (Ruttonsha) ... as usual, a subliminal effort of individualisation and puppeteering of the hapless customers. And there is no sign of salvation in the near future from this shabby assault on the customers by the hopelessly ambiguous type coding. Can't we have a unique and easily accessible nomenclature for semiconductor devices, at least among Indian manufacturers?

The environment of resonant information centered around Z has been short circuited unintentionally in very many cases. The well-known EZ and GZ rectifier series of the valve system caused much confusion in the zener field on their way to oblivion. Siemens Low Speed noise immune Logic or LSL series FZ 100 consists of basic gates, JK flip-flops and counters. The majority of Philips FRD xxx Z series are Random Accessible Memories. All the Zilog and Ferranti chips have Z as the first letter. The Ferranti's ZN414 which is an integrated circuit in three lead TO-18 housing, is an RF to AF detector. Anyway, a tree is known by the kind of fruit it bears. We can't remove a speck out of another's eye since we have a log in our own.

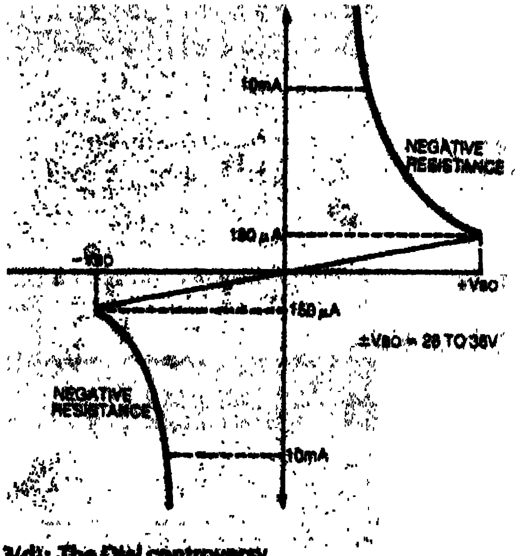

Fig. 3(d): The Diac controversy.

Ideal 'zeners' without zeners

A well-knit transistor combination can also produce similar breakdown characteristics as that of a zener diode. Constant voltage levels even well below 3-volt are possible by this technique. These reference devices are synthesised using transistors and resistors on a monolithic integrated network. Even though the power handling ability is quite low, these devices have an extremely comfortable temperature coefficient, which is the critical factor in the majority of potential applications. Table III gives an approximate comparision of reference networks of semiconductor devices.

TABLE III

Monolithic Zener Reference

Type	*Ref. Voltage*	*Drift With Temp. Millivolts/°C*	*Max. Current mA*	*Dynamic Impedance ohm*
LM 103	5.6	−5	10	15
LM 113	1.22	100	20	0.3
LM 129	6.9	0.07	15	0.6
LM 136	2.49	18	10	0.2
LM 299	6.95	0.0034	10	0.5
LM 399	6.95	0.0014	10	0.6

Buried zener diodes

MOSFET belongs to the first successful integration of semiconductor device with integrated circuit processing. The basic modes in the fabrication of MOS devices are the 'depletion' mode and the 'enhanced' version, of which the former is more frequently used. They have a high resistivity substrate to minimise the influence of substrate bias on 'threshold voltage.' Boron implantation technique in the channel provides the best trade-off between 'threshold voltage' and 'punch-through' voltage. In VLSI, the effective channel length is only a few micrometres and the thickness of gate oxide is 600°A, while line width ranges up to 5 micrometre.

The potential problem in the fabrication of MOS is the sneak paths of capacitive coupling associated with the fringing of the electric fields. In an ideal case the electric field intensity in the gate electrode must be perpendicularly incident. An increase in the gate insulation will result in distorted field intensity at the drain depletion region. The breakdown voltage is controlled by the proximity of the gate electrode to the depletion region. The radius of curvature of the junction region called the 'junction curvature' holds the trump card of the breakdown voltage. For a given impurity concentration the breakdown voltage increases with the increase in junction curvature. However, the reduction in the average breakdown voltage has been observed as a direct function of the separation of the edge of the drain diffusion and the gate electrode. This is because of the overall redistribution of electric lines of force near the drain region, causing the high level fringing of fields towards the gate electrode. This sort of reduction in breakdown

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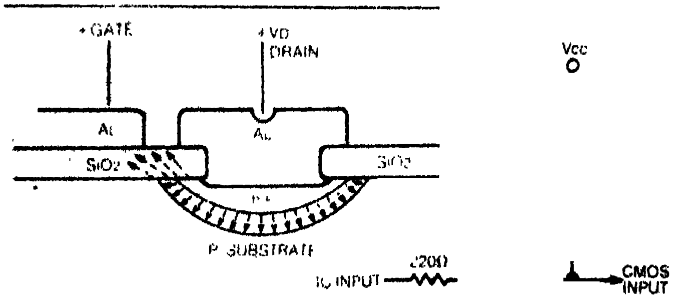

Fig. 4: Buried zener diodes.

voltage is acute if the gate electrode is grounded or even if it is left floating. The resistivity of the substrate or high doping concentration have very little effect on the reduction of breakdown voltage. Thus a conventional MOS gives rise to a process limited breakdown voltage of the order of 25 to 40 volts (Fig. 4).

The premature breakdown voltage in MOSFETs is extensively utilised to provide 'zener protection' for the MOS devices. This zener shielding prevents the effects of high voltage spikes and static charge rupture. A grounded gate electrode acts as a 'zener diode' of the conventional diffused structure. Since the oxide layer between the gate and the semiconductor is of the order of few tens of angstrom units, it is easily ruptured by relatively low values of transient voltage. Even human beings can become charged to voltages beyond 20 kV, just because of the friction between the skin and many types of materials such as silk, fur, plastics and synthetic clothings. Buried zeners provide a built-in protection against voltage, transients. If the input voltage is greater than the breakdown voltage, the process limited zener diode will conduct — restricting the maximum voltage applied to the gate electrode. This also chops off the input voltage of opposite polarity applied at the gate, because of the forward biasing of the newly formed zener at the gate input. However, this is not important in Enhancement version of the MOSFETs, because they don't require an opposite polarity voltage to achieve the 'on-off' operation (Fig. 4).

Zener diodes formed by the process facilities have a breakdown below the chip surface. This reduces the noise factor and long-term instabilities caused by the mobile charges in the surface of the oxide layer. The typical noise voltage is of the order of 3 nV per square root of frequency. Such buried zeners act as an excellent reference too! The buried zener reference on the 12-bit A/D converter AD567 is laser-trimmed to 10 volts, within one per cent error limit. AD567, introduced by Analog Devices Inc., in 1980 uses a buried zener design combined with an on-chip 'Silicon-Chrome' thin film 'application resistors' which are also laser-trimmed to the final reference level. AD567 is a 14-DIL chip which gives the 10-volt buried zener reference at pin 6 for the external application in the system.

(To be concluded next month)

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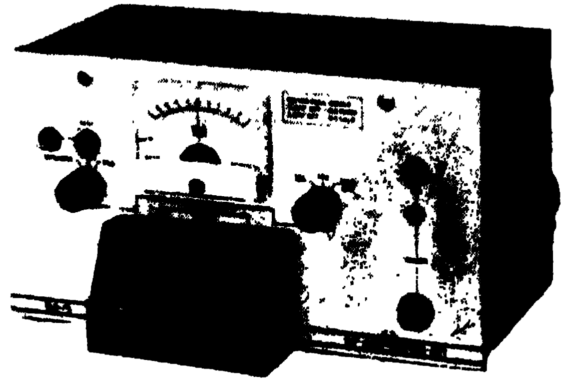

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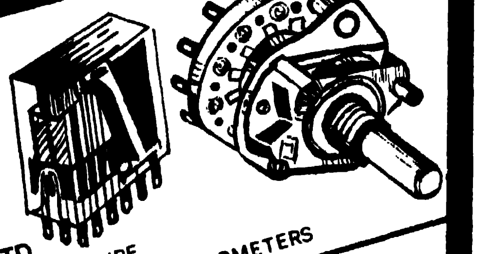

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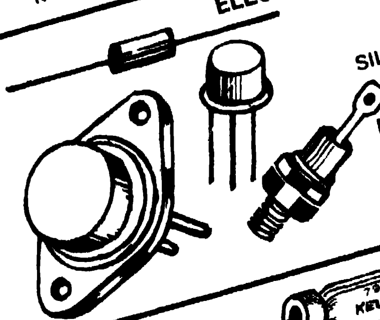

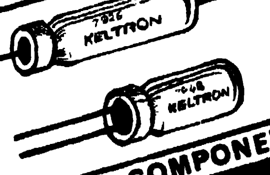

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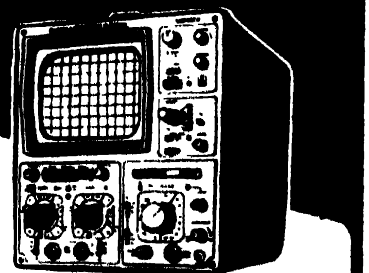

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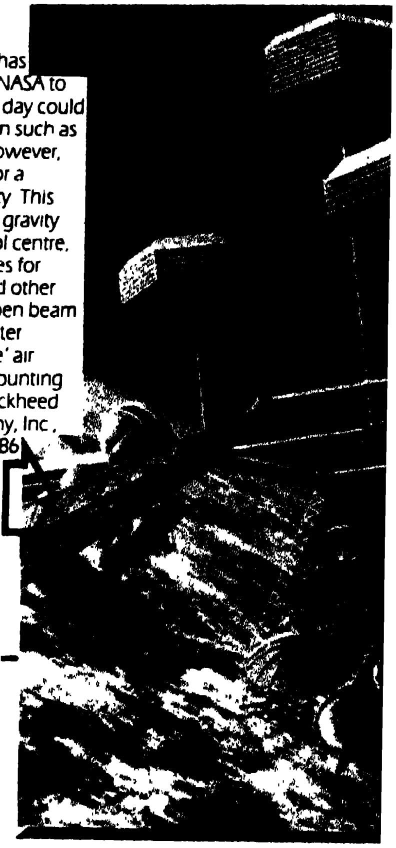
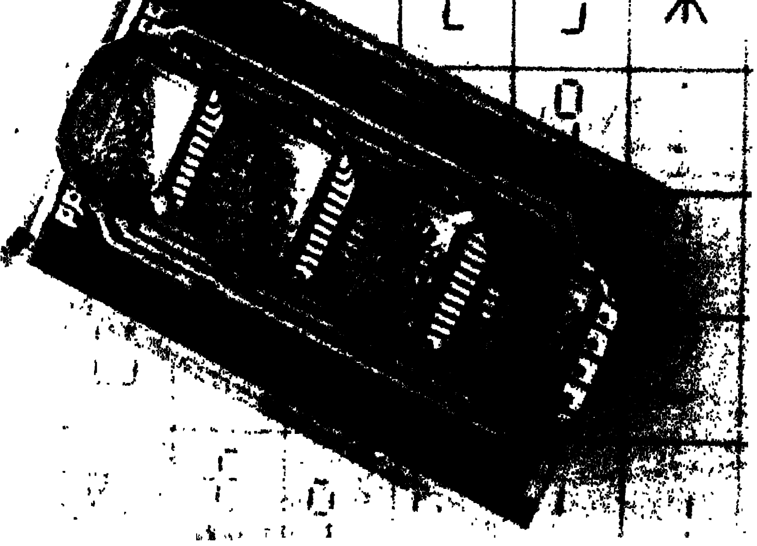
SPACE STATION CONCEPT. Lockheed has received a contract from NASA to conduct a study that one day could evolve into a space station such as this The current study, however, will identify user needs for a permanent orbiting facility This concept features artificial gravity living quarters and control centre, three zero-gravity modules for scientific, commercial and other applications and three open beam platforms which are all inter connected by 'shirt sleeve' air tubes and are used for mounting antennas and the like Lockheed Missiles & Space Company, Inc., Sunnyvale, California 94086



SMALL AND CAPITAL LETTERS DISPLAY. All the letters of the alphabet, both small and capital ones, as well as the usual digits and characters, can be produced using the 22 red-emitting segments of the LED displays with the designation DL 3422 which Siemens is now bringing onto the market Four such displays are grouped to form a 4-digit module which also contains a CMOS circuit with memory, character generator, multiplexer and driver. The alphanumeric character set of each cell comprises 96 different characters with a height of 4 3 mm/2 5 mm. The modules can be interconnected as desired to produce rows of any length.



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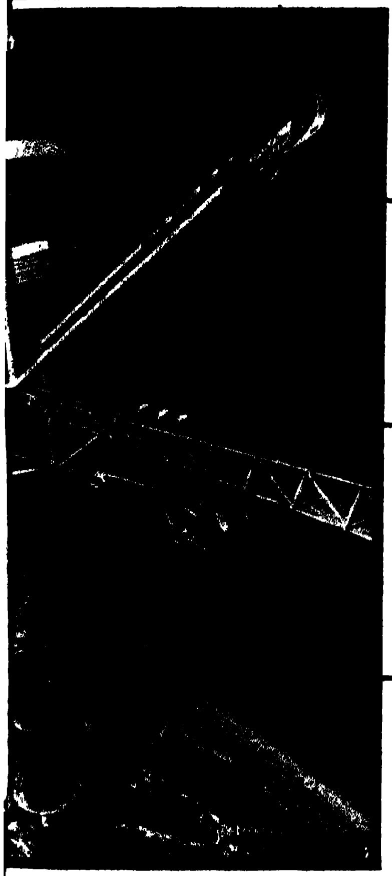
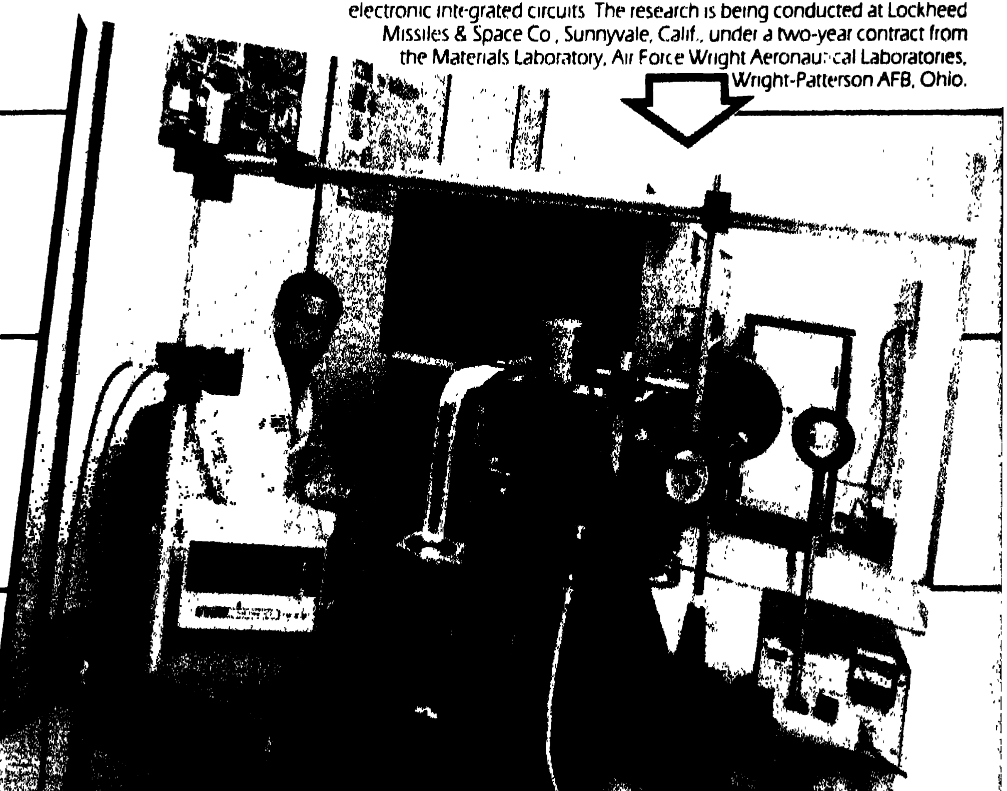


LASER EXPERIMENT TO PRODUCE SINGLE-CRYSTAL FILMS. Lockheed researcher Jerry Katzeff uses a neodymium glass laser in an attempt to produce defect-free, single-crystal films for use in electronic integrated circuits. The research is being conducted at Lockheed Missiles & Space Co., Sunnyvale, Calif., under a two-year contract from the Materials Laboratory, Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, Ohio.



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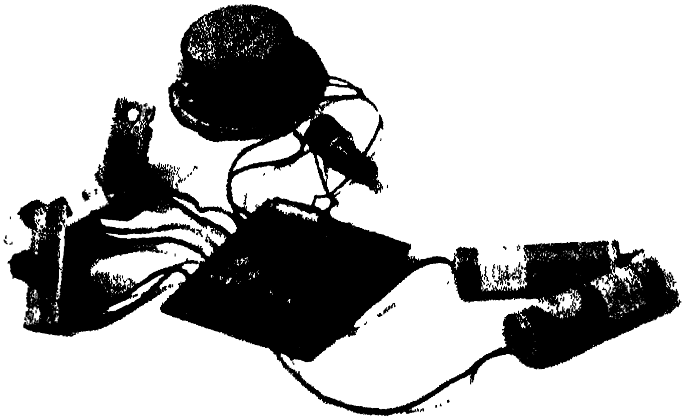

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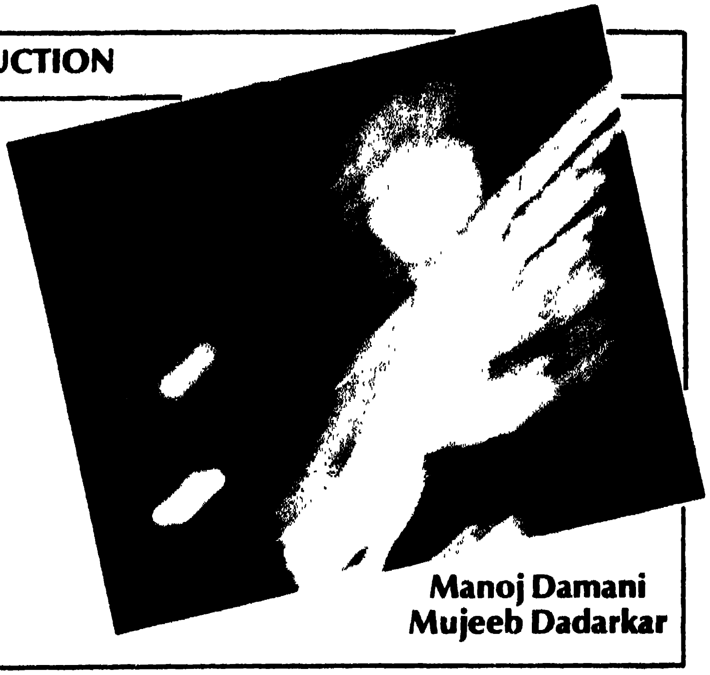

Manoj Damani
Mujeeb Dadarkar

With the advent of cheaper and more versatile synthesisers on the market, the guitarist finds it unavoidable to use as many effects as possible so as to make his sound interesting. Hence we find literally hundreds of effect units designed for use with the guitar (though they can be used on Bass and Organ also, among other things) on the market, ranging from the age-old 'Waa-Waa Pedal' to the recently developed 'Mouth Tube' effect, popularised by Peter Frampton and others; from the even more ancient 'Fuzz' to complex (and very expensive) modern effects like Chorus, Analog Delay, Flanging, Matrix Filtering, Ring Modulation, Phasing and various other tongue-twisters.

Of course the use of any or all of these effects entails a certain degree of skill and practice on the part of the performer, but you don't get to beat the synthesisers by relaxing all the time.

This article describes the construction of what is called 'Auto Wah', which is basically the 'Waa-Waa' pedal automated. In other words, the Waa-Waa sound is imposed on the instrument periodically, at a rate determined by a variable control. At slow rates the effect produced is similar to a manual Waa-Waa pedal, but the effect becomes more interesting at rates too fast to be produced using a pedal, a bubbling effect (not unlike phasing) is obtained. In fact many performers who have used the unit find, at the faster speeds, no audible difference between the effect produced by this unit and the much more expensive Phasers available in the market.

Working

The input passes through the frequency selective amplifier, which filters out all frequencies of the signal except a narrow band which is boosted and appears at the output (see Fig. 1). The position of this band in the frequency spectrum depends upon the value of the voltage controlled resistor (VCR), which is being altered periodically at a given rate by the triangle wave oscillator. This produces the auto-wah effect.

Circuit description

The complete circuit diagram of the Auto Wah unit is shown in Fig. 2. Since we doubtlessly accept the versatility and efficiency of the 741 operational amplifier, the design for the Auto Wah was evolved around this integrated circuit.

Input to the circuit is through blocking capacitor C1 and preset VR1 to pin 2 of IC1. This IC is used in the inverting mode as the filter and booster, gain being controlled by negative feedback. DC gain would be given by the ratio of R1/VR1, but the circuit is made frequency selective by introducing a T-network comprising C2, C3, VR2 and the FET T1 across the feedback resistor R1.

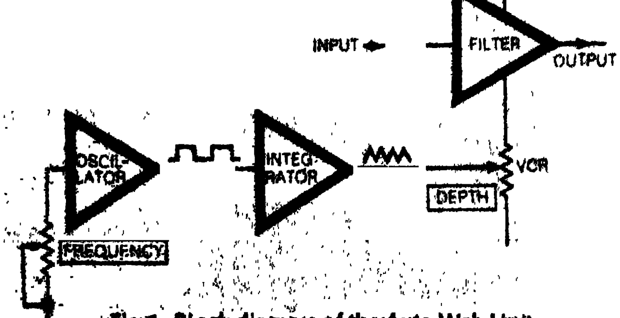

Fig.1: Block diagram of the Auto Wah Unit

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The effective feedback resistor, at any instant, has maximum value at a frequency determined by the value of the sum of the resistances of VR2 and T1 at that instant, since C2 and C3 are constant. Thus the amplifier has maximum gain at a frequency selected by the value of (VR2 + Rds) where Rds is the drain-to-source resistance of the FET. Any change in the value of this sum causes the amplified band to shift along the frequency axis, producing the Wah effect.

Control of this is achieved by using T1 as a voltage controlled resistance, since the relation between voltage at the gate and resistance across the drain and source voltage is linear or nearly linear. Harmonic distortion is eliminated by using a network comprising R2, R3 and C5 to feed half the AC signal appearing at the drain terminal into the gate of the FET.

IC2 is used as a free running multivibrator, producing a square wave as the capacitor C7 charges and discharges through VR3 and R5 whenever the voltage across C7 exceeds the fixed voltage at the non-inverting input of the device. VR3 thus affords control of the rate of oscillation.

Since the square wave available at the output of IC2 is unsuitable for feeding to the gate of the FET, IC3 is used as an integrator to convert the square wave to a triangular wave which can be fed to the gate of T1.

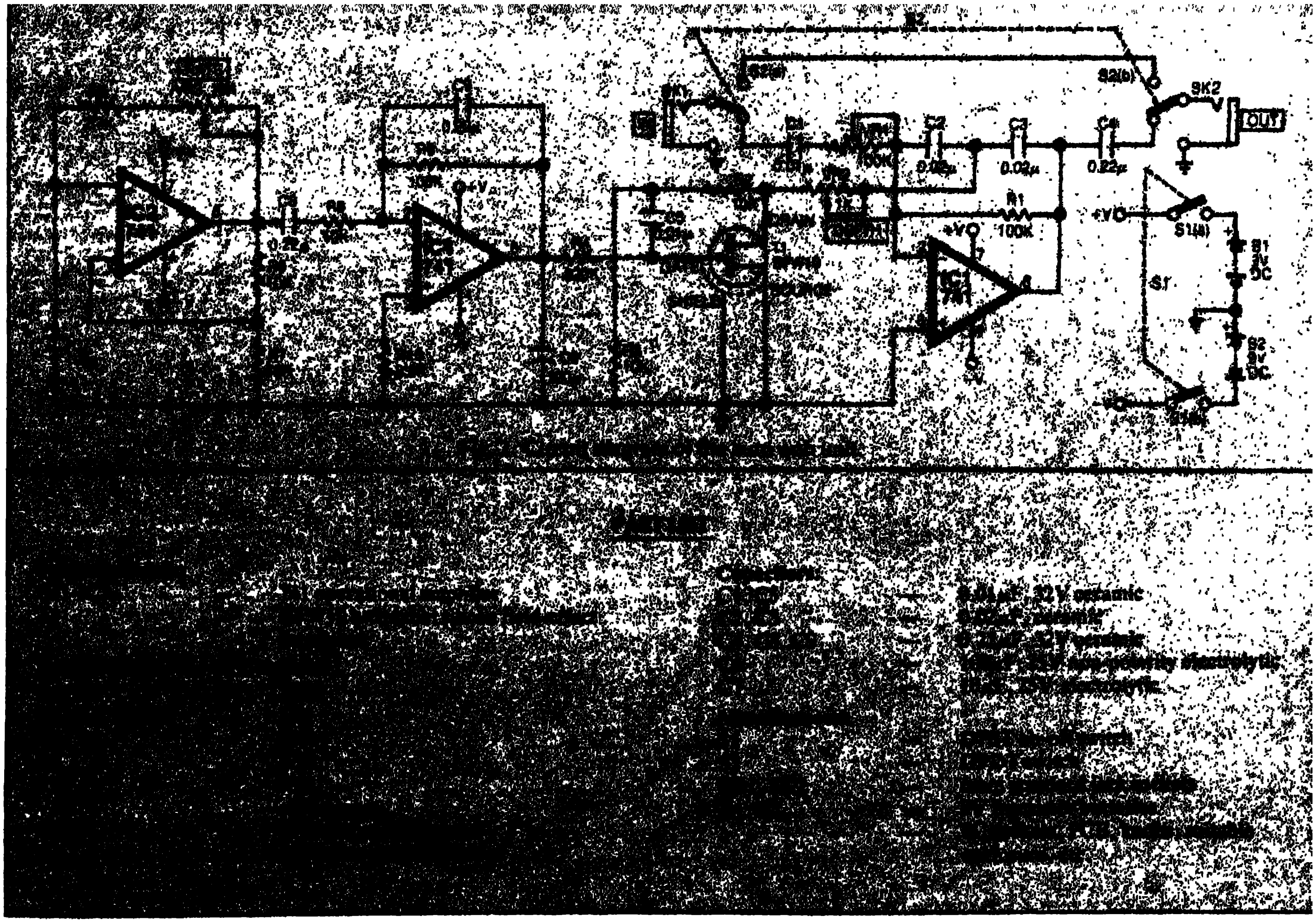
In our circuit, with IC3 being used as an integrator, R8 and C8 are chosen to suit the frequency of the square wave being fed into the input, and the output voltage required. This is then fed to the gate of T1 via R4.

C6 was found to be necessary to absorb some spurious clicks that appeared in the output. These noises emanate in the oscillator, and it may be necessary to earth the body of the potentiometer, VR3, or to increase the value of C6 if the clicks are audible in the built unit.

S1 is a DPST toggle used to switch the unit on or off; and S2 is a click-click type footswitch connected so as to bring the unit into the signal path in one position and to bypass it in the other.

In use

The unit is connected between the instrument and the amplifier. The input is fed through SK1, while output for the amplifier is taken from SK2. With the instrument and amplifier connected, VR1 and VR3 set about halfway, advancing VR2 towards minimum resistance, playing the instrument should produce the automatic Waa-Waa sound, at a rate of about 1 to 2 Hz.



If the effect is not heard, the footswitch S2 is in the bypass position or you have forgotten to switch on the power switch S1. With VR2 set at minimum resistance, advance VR3. The rate of Auto Wah should increase steadily, till it is like a bubbling sound when VR3 is at minimum resistance. If it is found that at this position the rate is too fast to produce any audible effect, R5 may be increased slightly from its nominal value of 2.7k to about 3k or 3.3k.

Also, it may be found that the rate of Auto Wah does not vary linearly with rotation of VR3. Upto about halfway, VR3 does not seem to produce much change in the rate, beyond this the rate increases linearly with further rotation of VR3. A logarithmic potentiometer was tried for VR3 and it was observed that the control functioned linearly upto the halfway point, beyond which the faster rates were compressed together. Since the unit sounds more interesting at the faster speeds, the linear potentiometer was preferred as it gave better control.

VR2 should control depth of Auto Wah; with VR3 set about half way, turning VR2 down to maximum resistance should cause a sort of tremolo in the sound but no Wah sound, with the auto-Wah sound appearing and becoming more vicious as VR2 is rotated towards minimum resistance. If a brighter sound than available with VR2 in this position is desired, replace C2 and C3 with 0.01 μF capacitors. Conversely, if the unit is to be used with bass guitars, its harmonic range will be on the higher side, so C2 and C3 may have to be increased up to 0.047 μF or even 0.1 μF each, the main criterion being the quality of the sound.

Coming to the function of VR1, this is a preset which gives some control over the Q-factor of the filter (i.e. the sharpness of the peak of the band passed). It is set to give the type of sound preferred by the constructor. There is, as may be expected, interaction between VR1 and VR2. So setting of VR1 should be done with VR2 at the maximum depth (i.e. minimum resistance). Also, VR1 causes some change in the gain of the unit, and after adjustment of VR1 overall gain may need to be increased or decreased by increasing or decreasing the value of R1 slightly.

After all these procedures have been completed, the unit may be dismantled for painting. (Our case was of aluminium, anodised to a dark violet shade.) Labels may be used to indicate the input and output jack sockets, and RATE and DEPTH controls. Rubber feet should be screwed on to the base of the unit to prevent it from slipping while in use.

Now jack in, set the rate and depth controls to give the required effect, and thump on the footswitch to bring in the effect whenever needed. ☐

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D. Linga Reddy

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The calendar can be set every morning by just pusing a switch, and even that may not be necessary if it is connected to a digital clock. By connecting the PM indication pin of the clock to input of date section of the calendar, automatic advancement of the 'date' every 24 hours can be ensured. The combination of the clock and this calendar would thus show the time, day, date, month and the year automatically. The year will, however, have to be reset (internally) on the first of each January.

Working

A bounce-free switch (S1) is used to change date, as shown in Fig.1. An R-S flip-flop is made with the help of simple and inexpensive NAND gates (N1, N2). N1's output is connected to the input (pin 14) of IC1 (decade counter 7490 connected in divide-by-10 mode) through push-to-off switch S2.

TABLE 1

IC7447 DCBA	*Decimal*	*Natural Outputs* abcdefg	*To be modified Outputs* abcdefg
0 0 0 0	0	0000001	
0 0 0 1	1	1001111	
0 0 1 0	2	0010010	
0 0 1 1	3	0000110	
0 1 0 0	4	1001100	
0 1 0 1	5	0100100	
0 1 1 0	6	1100000	0100000
0 1 1 1	7	0001111	
1 0 0 0	8	0000000	
1 0 0 1	9	0001100	0000100
1 0 1 0	0	0000001	

The BCD outputs from IC1 are fed to IC2 (BCD-to-7-segment decoder/driver 7447), and from IC2 to DP1 (common-anode, 7-segment LED display FND507) through current-limiting resistors (R1 through R7) to glow as units of date (0 through 9). Transistors T1 and T2 (BC109) are used to give proper shape to the digits '6' and '9' so that they appear as 6 and 9 instead of b and 9. This action is made clear by Table 1.

The D output (pin 11) of IC1 is fed to the input (pin 14) of IC3 (7490 connected in divided-by-4 mode). IC4 and DP2 (tens of date display, FND507) are connected in such a way that whenever A and B outputs (pins 12 and 9) of IC3 go low, display DP2 is to increase the 'blank.' The blanking is used so as to reduce the current consumption and to increase the life of DP2, throughout the dates from 1st to 9th of every month, in a year.

If ripple-blanking input (pin 4) of IC4 is low (0), the seven outputs of IC4 go high (1), forcing DP2 to the blanking state. Truth Table 2 explains the action.

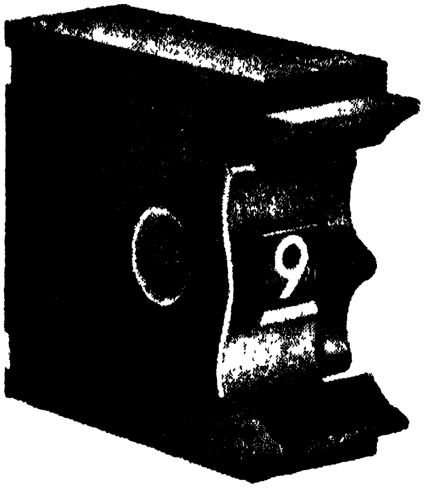
TABLE 2
OR gate Truth Table

A	*B*	*A + B = X*
0	0	0
0	1	1
1	0	1
1	1	1

Resetting of the dates circuit is done by AND gate A1 (1/3 7411, triple 3-input AND gate). Only when the AND gate output is high (1), both IC1 and IC3 get reset.

Table 3 is self-explanatory. It shows that 32 dates (0 to 31) are displayed in all. Of course, there is no need of displaying '0' date. But with these ICs (IC1 and IC3) one cannot preset to date '1', though by using extra circuitry one can achieve this.

Mr D. Linga Reddy is a lecturer in Physics for postgraduate courses in Engineering, Physics and Instrumentation at Osmania University.



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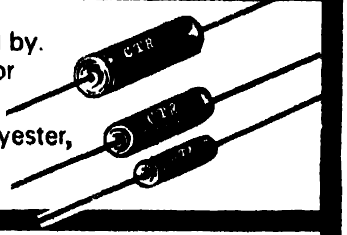

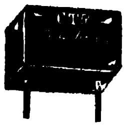

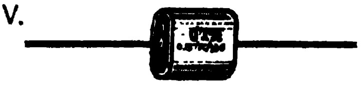

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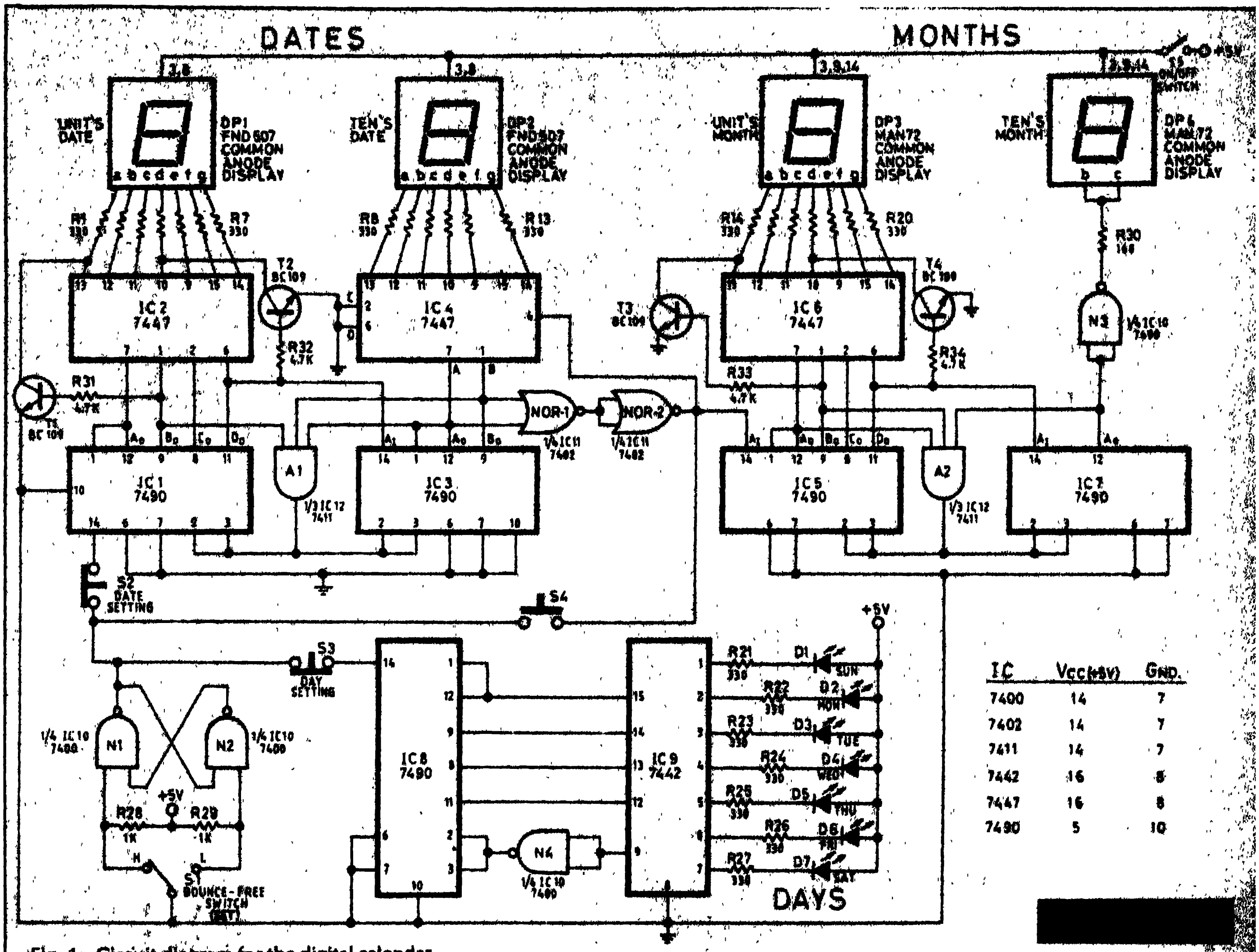

[redacted]

Fig. 1: Circuit diagram for the digital calendar.

PARTS LIST

Semiconductors:	
IC1, IC3, IC5, IC7 IC8	—7490 decade counter
IC2, IC4, IC6	—7447 BCD-to-7-segment decoder/driver
IC9	—7442 1-of-10 decoder
IC10	—7400 quad 2-input NAND gate
IC11	—7402 quad 2-input NOR gate
IC12	—7411 triple 3-input AND gate
IC13	—7805 5-volt 1-amp voltage regulator
T1 - T4	—BC109 low frequency silicon transistor
D1 - D7	—LED
DP1, DP2, DP5 - DP8	—FND 507 common-anode display
DP3, DP4	—MAN 72 common-anode display
BR1	—OB2 bridge rectifier
Resistors (all ¼ , ± 5% carbon):	
R1 - R27	—330-ohm
R28, R29	—1k
R30	—168 (100 + 68) ohm
R31 - R34	—4.7k
R35	— 165-ohm
R36, 37	— 56-ohm
R38	— 68-ohm
Capacitors:	
C1	—1000μF, 25V electrolytic
C2, C4	—0.01μF, 32V ceramic
C3	—100μF, 25V electrolytic
Miscellaneous:	
X1	—230V primary; 9V, 1A secondary transformer
F1	—500mA fuse
S1	—Push switch (see text)
S2, S3	—Push-to-off switch
S4	—Push-to-on switch
S5	—On/Off switch
	—IC sockets, PCB, heatsink for IC 13, mains cord, suitable enclosure etc.

The B output (pin 9) of IC3 is fed to the input (Pin 14) of IC5. The action and circuit of this section for displaying the months is exactly similar as that of the date counter (the combinatin of IC1, IC2, DP1, T1 and T2).

The output (pin 11) of IC5 is fed to the input (pin 14) of IC7 (connected in divide-by-2 mode). The tens of

TABLE 3

IC2				IC1				Display	
D	C	B	A	D	C	B	A	Tens	Units
0	0	0	0	0	0	0	0		
.	.	.	.						
0	0	1	1	0	0	0	1		
0	0	1	1	0	0	1	0		
0	0	0	0	0	0	0	0		

months display (DP4) has to glow only in the months of October, November and December. This requires the A output (pin 12) of IC7 to be high (1). Since all the displays (DP1 to DP4) used here are common-anode type, to invert the high signal a NAND gate N3 is used. Alternatively, one can use common-cathode display for DP4 and avoid N3. Just pick up any 7-segment display from junk-box, whose 'b' and 'c' or 'e' and 'f' segments are in good condition. Another alternative is to use two simple bar (single-segment rectangular) LEDs. Thus, a decoder/driver IC can be saved.

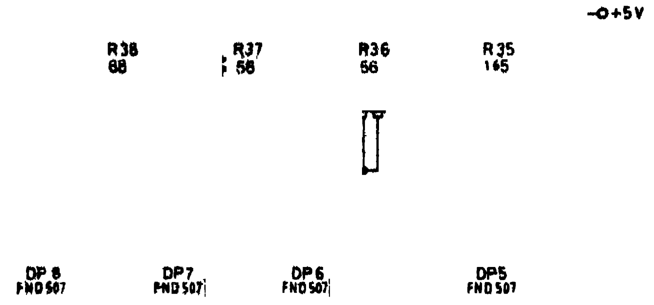

Fig. 2: LED display connections for showing the year 1983.

Resetting of months circuit is done by the AND gate A2.

From Table 4 it is evident that divide-by-13 mode is used for months (0 to 12), and the same difficulty of an unnecessary display of '0' comes after 12. One can overcome this also by using some extra circuitry, but it may not be worthwhile.

TABLE 4

IC7				IC5				Display	
D	C	B		D	C	B	A	Tens	Units
0	0	0	0	0	0	0	0		
0	0	0	1	0	0	1	0		

Day indicator

The day indicator circuit is the same which appeared in Feb.'81 issue of EFY (Mr Subhas Sarkar's article).

N1's output is simultaneously connected to the day indicator input (pin 14) of IC8. Push-to-off switch S3 is included so that the day may not change during date setting from 31 to 0 and then to 1, or at the end of months having 30 or lesser number of days when date alone needs to be set. For all the remaining dates, the date and day change simultaneously on pusing S1 which may be a push switch instead of the toggle switch shown (for a clearer visualisation).

As an option one can use a month setting switch S4 (one-pole two-way toggle or push-to-on switch). It is useful where the power failure is frequent. As and when the power restores, the months display would show '0'. As it would be a tedious job to set the month by pushing switch S1 31 times the number of the month (31 × 11, if the month is November, for instance), switch S4 would prove useful to reset the month on restoration of electric supply.

The year display is again purely optional. The 7-segment LED displays (4 × FND507) may be connected as shown in Fig.2, to show the year 1983. Once in a year the units of the year display will have to be wired to show that particular year. The current limiting resistors are not used for all the segments individually, as in the usual counters, but connected to the common anodes collectively, from the 5V supply (pins 3 and 8) to each display.

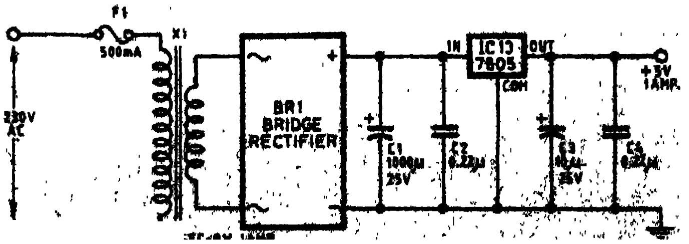

Fig. 3: Circuit for 5V, 1A ripple-free stable and regulated power supply.

Construction

Fig.3 shows the circuit for a fixed 5-volt, 1-amp ripple-free, stable and regulated power supply. The regulator IC10 (MC7805) is provided thermal and short circuit protection. It is a simple and standard circuit for power supply.

Fig. 6 shows the pin connections of some ICs and displays used in this project. Fig. 4 shows actual-size double-sided PCB pattern for the digital calendar, while Fig. 5 shows the components layout for the double-sided PCB shown in Figs 4(a) and 4(b).

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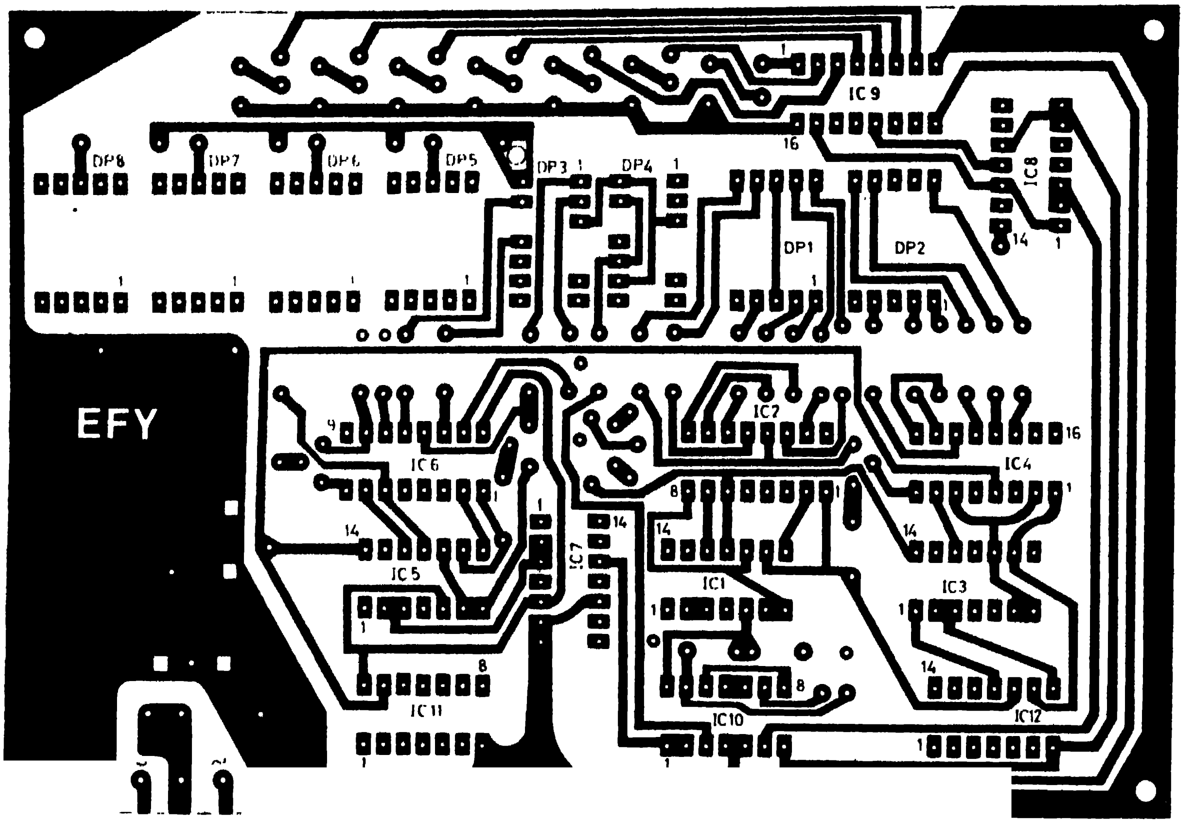

Fig. 4(a): Actual-size pattern for one side of the double-sided PCB.

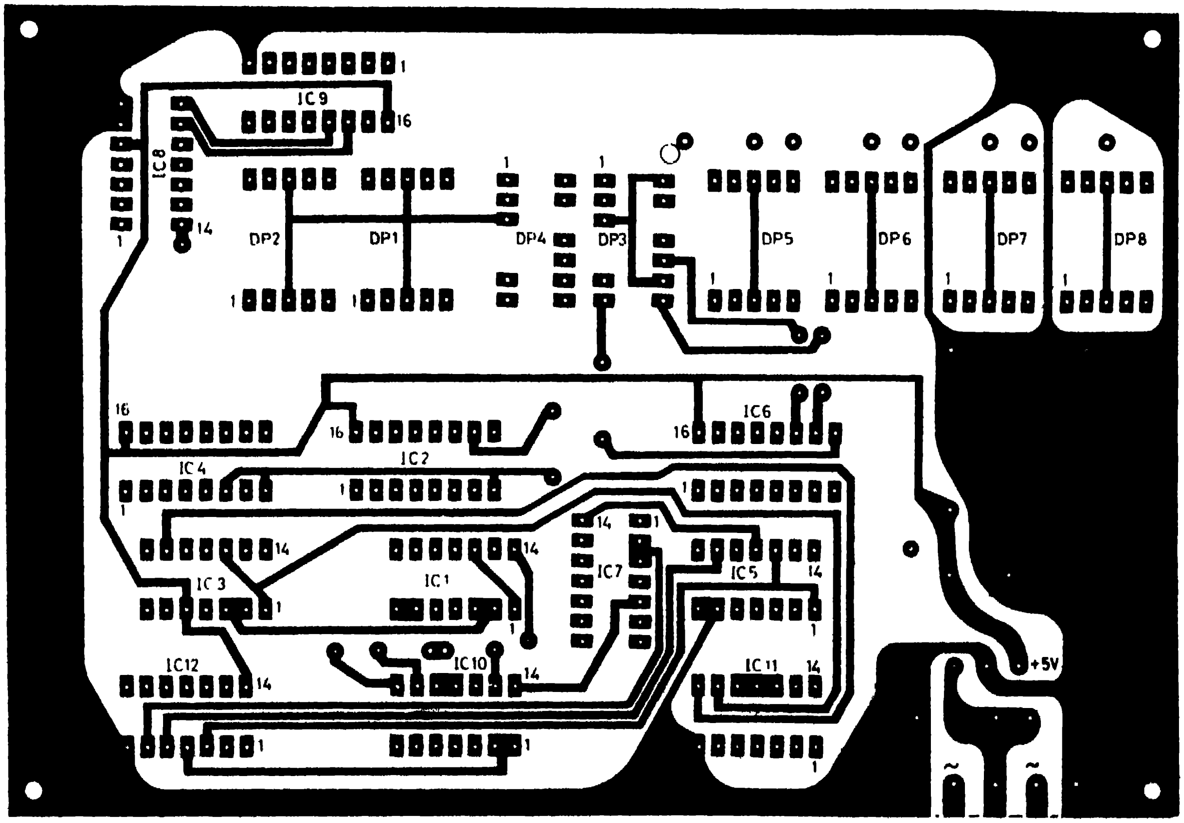

Fig. 4(b): Actual-size pattern for reverse side of the PCB.

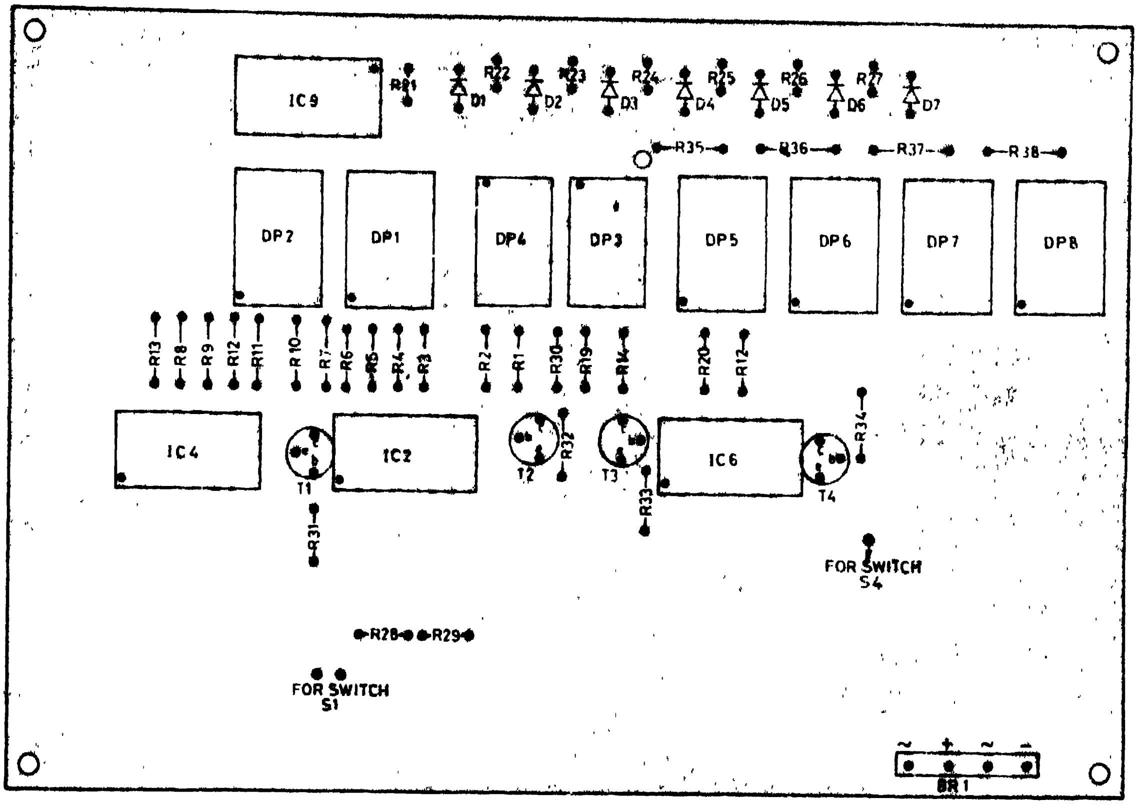

Fig. 5(a): Components layout for first side of the PCB, shown in Fig. 4(a).

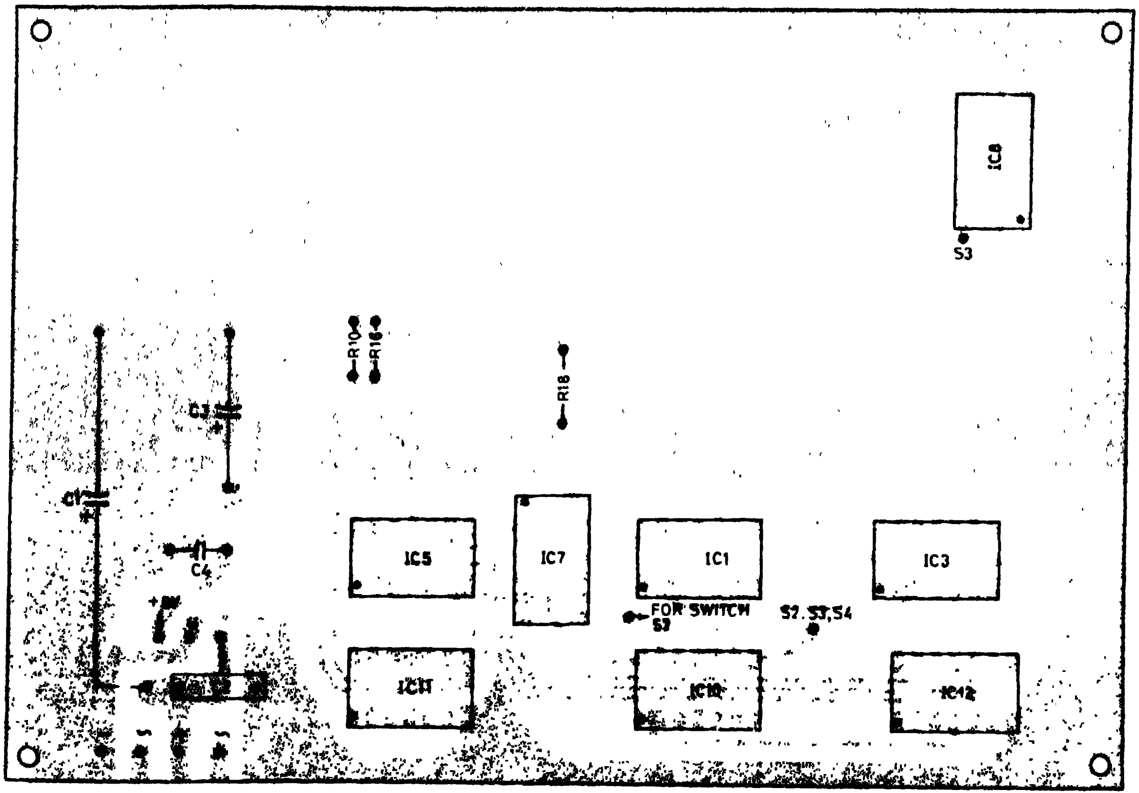

Fig. 5(b): Components layout for reverse side of the PCB, shown in Fig. 4(b).

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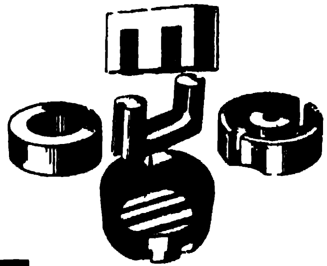

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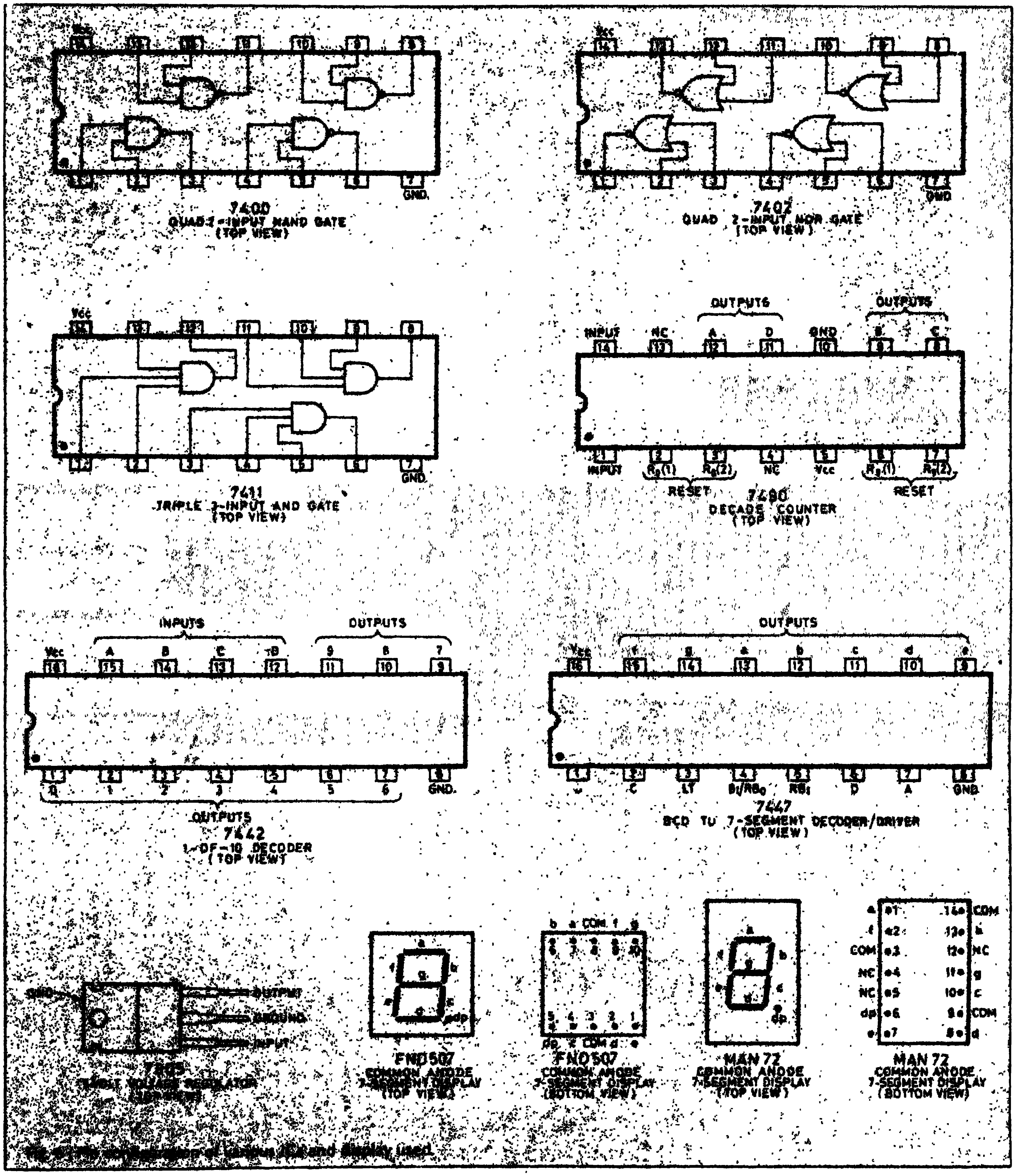

Fig. [illegible]: Pin configuration of various ICs and display used.

As a whole, this digital day, date, month and year calendar is most economical to the extent possible, involving a minimum number of ICs and diaplays that are available easily in the market. Also, this calendar can be coupled to a digital clock, if available, thus avoiding manual setting daily. □

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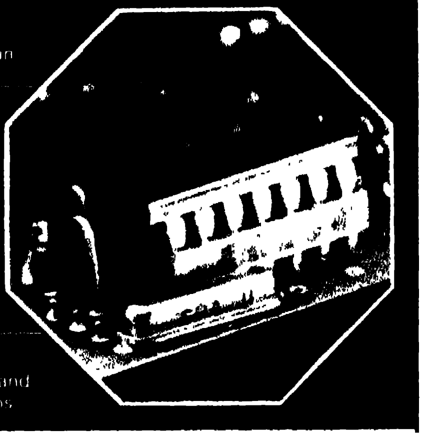

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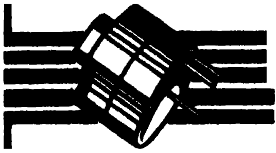

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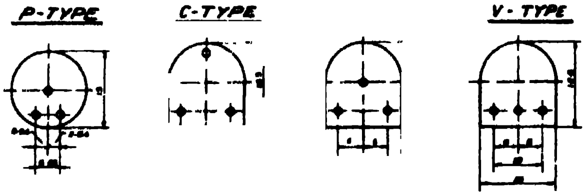

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circuit ideas

Key Bounce Eliminator for Single Contact Key

Here is an inexpensive circuit which may be used to eliminate the make and break key bounce of single contact keys. It uses only two ICs—74123, a dual retriggerable monostable multivibrator and 7400, a quad 2-input NAND gate — and a few resistors and capacitors.

The circuit is shown in Fig. 1. Before explaining the circuit, let us understand what key bounce is for the benefit of those who have experienced it but did not understand.

When a single 'make contact' key is released, it is found that before making the final contact, in the transition from no contact to contact, which may be from a few tens of nanoseconds to few hundreds of nanoseconds, the key in fact makes several makes and breaks. Similar observations are made while releasing the key. In certain applications, where the operation is edge triggered, this may not be desirable at all. For instance, if this key is at clock input of a toggle flip-flop, multiple triggers instead of one may go when the key is activated, which makes the key functionally inoperative for this purpose. Thus, it becomes an absolute must to have a circuit which gives only one pulse when the key is depressed.

Fig. 2 shows the various waveforms observed in the circuit. P is the waveform when the key is depressed, showing the key bounce at make and break. B1 is inverted waveform of P. At the rising edge of B1 the first monostable of 74123 is triggered. 74123 is a retriggerable monostable so that it gives a pulse determined by its RC time constant from the last bounce of key. This time constant is chosen to be about 5 milliseconds so that no pulse at output results if the key is depressed for less than this period. This ensures that output pulse occurs on genuine key depression and not with spurious trigger resetting from switching transients in power supplies of ICs.

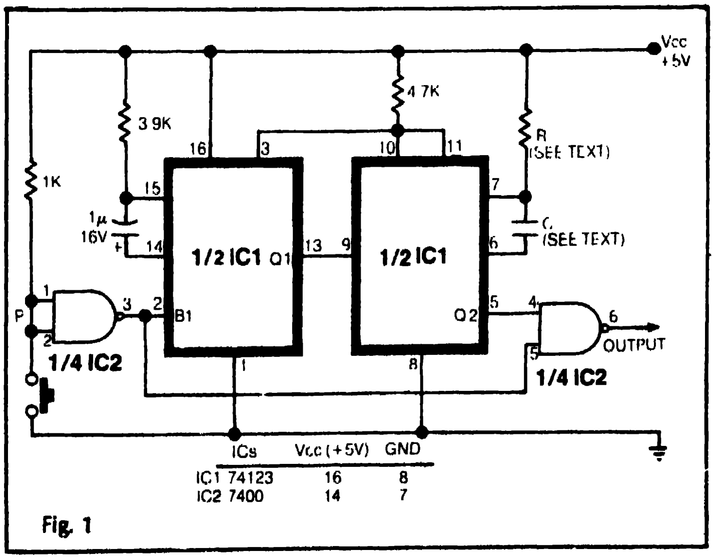

Fig. 1

Q1 is the waveform at output of first monostable. The dotted portion is one which may or may not occur, depending on key bounce at break (first monostable is triggered at positive edge). The falling edge of Q1 triggers the second monostable, whose time constant can be chosen according to the pulse width required, which may be up to several tens of microseconds (T = 1.2 RC).

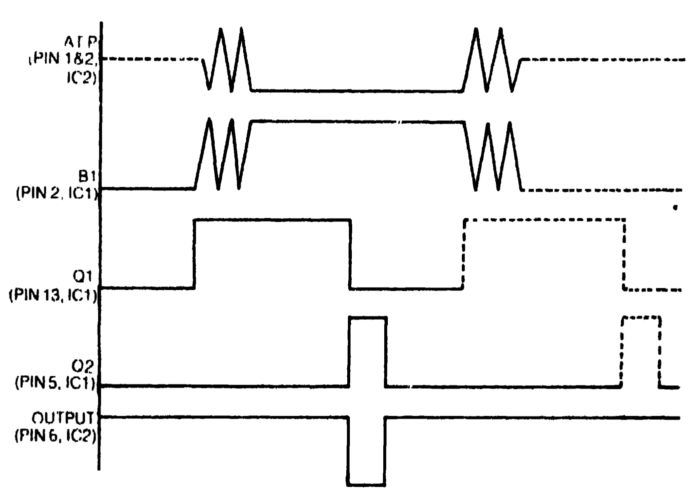

Fig. 2

The output waveform of second monostable is shown in Q2. The dotted portion is one which occurs if there is bounce at break of key contact. The output Q2 is NANDed with B1 to give output. We see if the key was depressed for more than 5 milliseconds then NAND of Q2 and B1 gives an output pulse as shown. The dotted pulse of Q2 does not give any output pulse when NANDed with B1 which now is 0. Thus the key bounce is eliminated.

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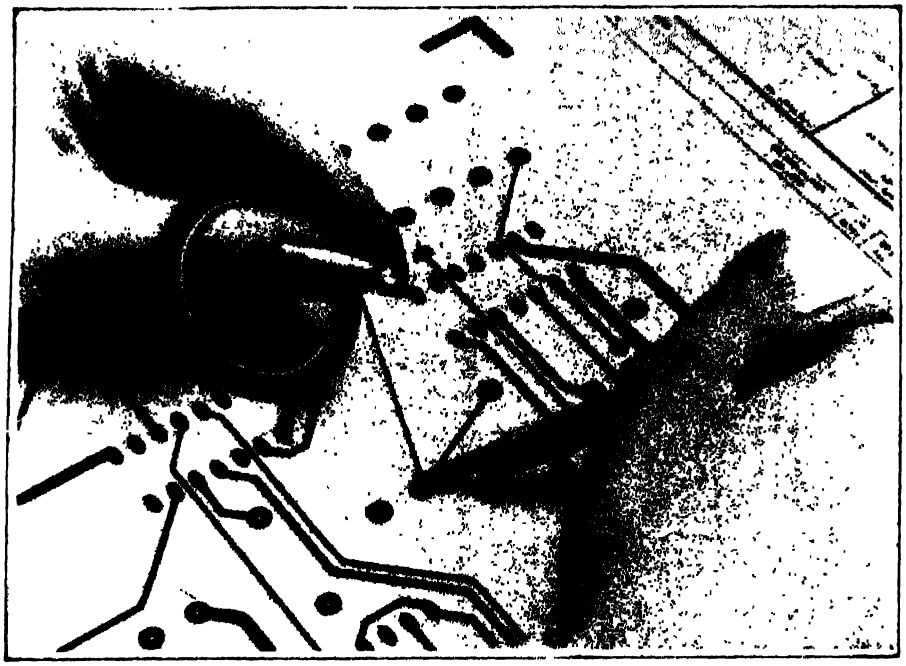

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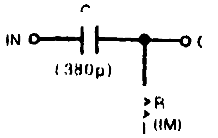
High-Quality Noise Filter

Quite often in turntables the normal audio is accompanied by a low frequency rumbling sound generated by the revolving turntable. Most people turn the bass control down to the minimum to eliminate this sound. The rumbling sound vanishes, but so does the rich bass. Since most tone control circuits have a maximum slope of 6 dB per octave, the cutting of frequencies starts from about 600 Hz and below such that in order to cut off a rumbling sound of 100 Hz or below, parts of higher frequencies are simultaneously eliminated to a considerable extent.

Here is a general high-pass RC filter circuit (Fig.1) which cuts off the desired low frequencies, eliminating most of the 'disturbances' and only a negligible amount of the programme's bass.

Typical example:



As we know, the reactance offered by C ($X_c = 1/2\pi fC$) is inversely proportional to the frequency of a signal. The choice of R and C is, therefore, made in such a way that the capacitor offers an impedance of 10-megohm at 50 Hz. Neglecting the effects of phase angle, only one tenth of the signal appears across R. At 1000 Hz however the same capacitor offers an impedance of 0.5-megohm, i.e. two-thirds of the original voltage will appear across R. The slope of attenuation of such circuits is 6 dB per octave, but when cascaded with another similar circuit the effect is multiplied to give the desired result.

When the stylus moves on an old worn-out record, it generates a hissing sound. The proposed general circuit has the same approach as the rumble filter.

The components required are easily available in the market. For L1 and L2 use 3H, 10mA filter choke (with centre-tap). The connections should be as short as possible. Use shielded wire throughout and enclose in metal box.

The circuit should be used with a medium-power amplifier and incorporated between the pre-amp and power-amp stages. With slight modifications it can be made to filter a variety of frequencies.

SOMNATH BANERJEE

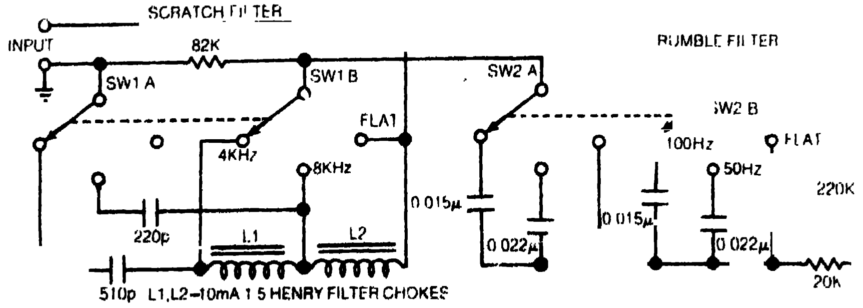
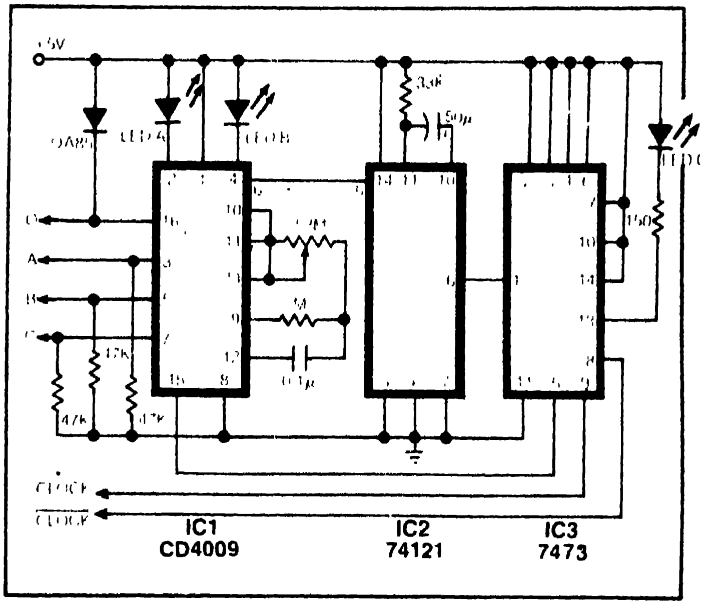


Fig. 1 :

CMOS/TTL Versatile Test/Probe

A digital testing circuit that can be used to test or probe both CMOS and TTL ICs is presented here. It uses only three ICs. There are two (simultaneously usable) logic state probes; a pulsating mode detector and two clock outputs. The clock and its complementary signal (simultaneously usable) take care of all your clocking needs while testing digital hardware.



The circuit, as shown, works from a+5V TTL supply. CD4009A is an inverting buffer cum CMOS-TTL translator. It is also used to generate the clock. 74121 one-shot is used in the pulsating mode to flash LED C when input C is pulsating at any frequency. 7473 is a dual JK flip-flop.

Connect point Q to the positive supply of the CMOS/TTL circuit under test. Probes A and B are the logic state detectors. If input A or B is high, the corresponding LED glows. Probe C is to detect pulsation. Even if input is toggling at high frequency, LED C is flashed at a slow, constant rate. (If the input is not pulsating, LED C assumes either 'on' or 'off' state, which does not signify anything.) Absent in most level probes, this is a useful feature.

The clock and its complementary output are variable from around 2 Hz upwards, by varying the 2.2-megohm control resistor.

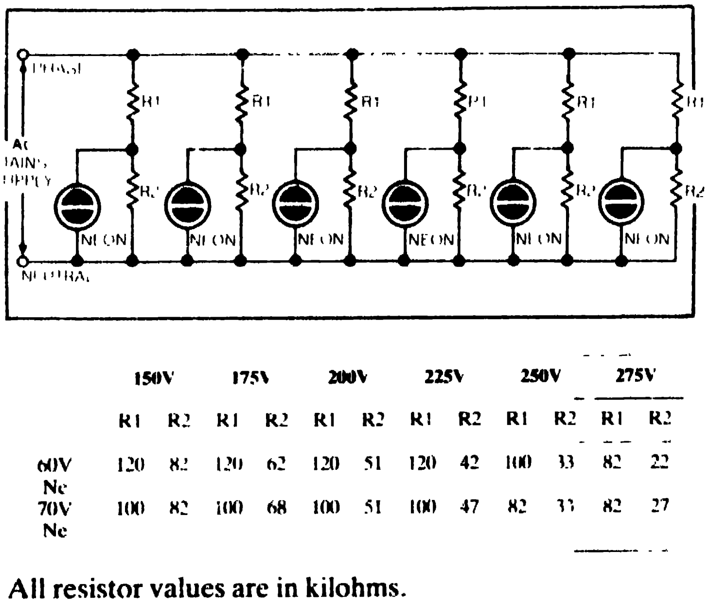
AJITH KUMAR N.

Bar-Graph Mains VoltageIndicator

This circuit indicates the AC mains voltage in the form of a bar-graph display, and can be useful to hobbyists — particularly in areas where the voltage fluctuation is severe. The display is graduated in 6 steps of 25V from 150V to 275V. The neon lamps light up in succession as the voltage increases from 150V to 275V with one lamp lighting up at 150V and all the six lamps lighting up at 275V.

The circuit for each voltage level consists of a neon lamp and two resistors. The neon lamp lights up when the voltage across R2 is equal to the breakdown voltage of the neon lamp. The values of R1 and R2 are selected such that the neon lamp lights up at the designated voltage level.

Since neon lamps available in the market usually have breakdown voltages ranging from 60V to 75V, values of R1 and R2 for neon lamps with breakdown voltages of 60V and 70V are given. However R2 can be replaced by a 100k preset in each voltage level. The display can now be calibrated by using a variable AC source to give 150V and adjusting R2 at that level so that the neon lamp just turns on. The voltage is increased and the other presets are similarly adjusted.



	150V		175V		200V		225V		250V		275V	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
60V Ne	120	82	120	62	120	51	120	42	100	33	82	22
70V Ne	100	82	100	68	100	51	100	47	82	33	82	27

All resistor values are in kilohms.

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LCU	ELAT 4042/02	ELAT 4042/02	ELAT 4042/02	ELAT 4042/02	ELAT 4042/02
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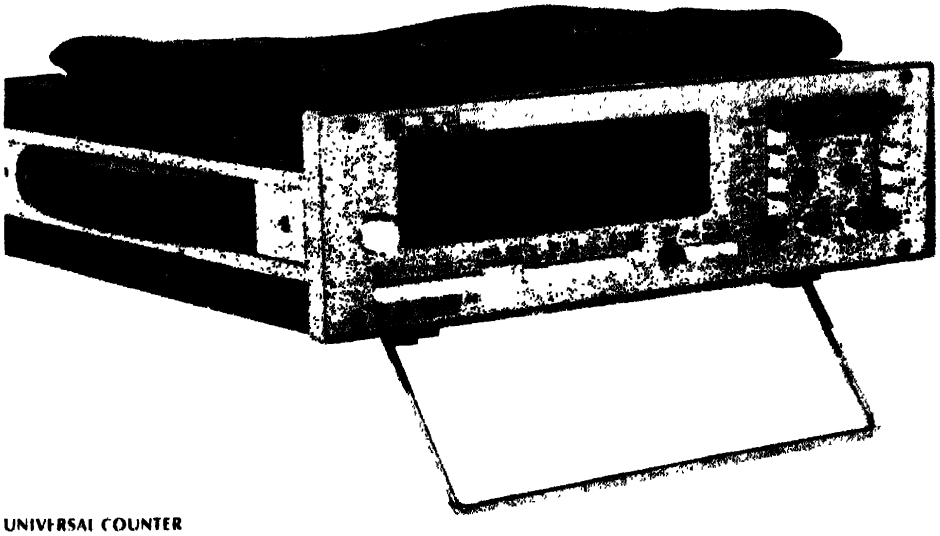
A 10MHz oven-controlled time base is incorporated. Time interval measurements can be performed with 100ns resolution on non-repetitive signals. With averaging this resolution improves to 1 ns for signals which are repititive.

The other unique features include multiplexed BCD output on the rear panel, facility to monitor trigger level settings on channels A & B, programmable time base output 0.1 Hz to 10 MHz and provision to use an external time base input.

Contact: Hindustan Instruments Ltd, Vishal Bhawan, 95 Nehru Place, New Delhi 110019.

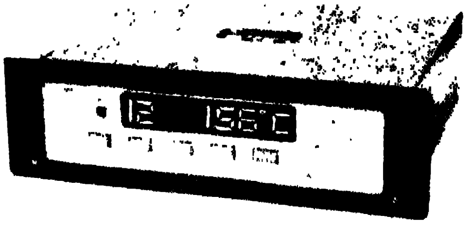


UNIVERSAL COUNTER

DIGITAL AUTO TEMPERATURE SCANNER

Arun claims to have introduced Digital Auto Temperature Scanner for the first time in India at the most economical price. Its channel switching is based on CMOS technology instead of the conventional reed switches, and the channel number and corresponding temperature are indicated by 7-segment LED display.

The scanning rate can be selected from 1 second to 15 seconds per channel by pushbutton switches. Hold mode facility helps to freeze a particular channel reading. Thermocouple break indication is provided by LED lamp.



DIGITAL & AUTO TEMP. SCANNER

The scanner is available for all standard industrial thermocouples.

Contact: Arun Electronics Pvt Ltd,
B 125/126 Ansa Industrial Estate,
Sakivihar Road, Sakinaka,
Bombay-400072

CLAP LIGHT

This simple electronic bedlight, called 'Clap Lite' by the manufacturer, can be put on or off by just clapping one's hands, or through any other similar sound produced within 3 metres from it. It works on 230V AC mains but draws very little current as it uses a small 0.6W bulb only for lighting. Price: Rs 95.

Contact: Barathtronics, 53 Temple Street, Malleswaram, Bangalore 560003.

SERVO STABILISERS

'NEI' Servo Voltage Stabilisers employ relayless solidstate circuitry to control the servomotor for stepless voltage correction at high speed without overshoot. The output remains within ±0.5% of the desired voltage, without any waveform distortion.

The stabilisers claim high efficiency and remain unaffected by line frequency variation (between 47Hz and 62Hz). Auto/Manual facility options are available at the front panel.

Single-phase servo stabilisers with 230V nominal output are available in 0.5 kVA to 18 kVA capacities. Three-phase balanced output stabilisers with 400V nominal output are available in 6 kVA to 90 kVA capacities, and unbalanced output type (3-phase, 400V output) are available in 6 kVA to 45 kVA capacities.

Contact: Nagar Electronics & Instruments Pvt Ltd, 5/3 West Patel Nagar, New Delhi-110008.

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POONA
☐ Trio Radio
☐ Nagesh Elec & Electronics
TRIVANDRUM
☐ Ace India

MINIATURE RELAYS

PLA Series M Miniature Relays (modified version) employ, special assembly which absorbs transit bumps, thereby preventing any damage to contact blades in the transit. It is available in basic 3 types: MCO (open-type), MCC (enclosed) and type MPC (plung-in)

MINIATURE RELAYS

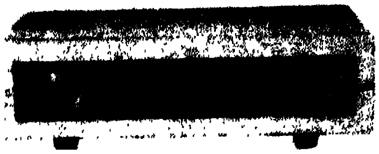
Basic relay in type MPC instead of being suspended by weight of wires is rigidly fixed to the base. This unique feature safeguards the relay under transit bumps. Embedded brass inserts in the cover in place of threading generally adopted avoids crack development inside the cover.

Available with 1, 2 and 3C/O contacts rated for 6–amp duty with coils suitable for 6 to 240V AC/DC.

Contact: Sai Electronics, Thakor Estate,
Kurla Kirol Road, Vidyavihar (West)
Bombay 400086.

CLOCK-CUM-DEFROSTER

'IONtime' automatically switches off a fridge every night, and restarts it after 2¼ hours. The frost accumulated during the day melts-out within this period. As a result, the fridge works more efficiently, electrical consumption reduces by 8% and weekly cleaning is not required.



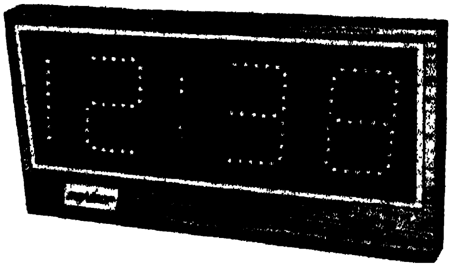
CLOCK CUM DEFROSTER

Connecting IONtime is very simple, and there is no need to call an electrician or a mechanic for this purpose. Besides, IONtime serves as an accurate quartz controlled Digital Clock.

Contact: Ion Electricals,
307 Owner's Industrial Premises,
505 Gabrial Road, Muhim,
Bombay-400016.

DIGITAL CLOCK

'Sensor' Digital Electronic Wall Clock introduced by Product Promoters, being crystal based, gives an accuracy of 15 seconds a month. It operates on 230V AC mains, but battery back-up is provided by six. 1.5V cells. Though display remains off during mains failure, exact time is displayed on return of power.



DIGITAL CLOCK

Time is displayed through nearly 9cm high digits comprising red LEDs in 7-segment arrangement, so that it can be seen comfortably from as far as 20 metres.

Contact: Product Promotors,
Post Box 3577, Lajpat Nagar.
New Delhi 110024.

CURRENT TRANSFORMERS

'Meco' introduces DIN type current transformers, conforming to DIN 42600 specifications. that are housed in ABS plastic casing, suitable for metering application.

The central opening is rectangular in shape and hence can be slipped over Bus bar easily. These CT's, supplied with cap for sealing the secondary, can be used in dusty environments too. Mounting brackets are supplied at extra cost.

CURRENT TRANSFORMERS

Standard ranges available are from 50/5A to 600/5A, withstanding load from 1.5 VA to 15 VA.

Contact: Meco Instruments Pvt Ltd,
310 Bharat Industrial Estate,
T.J. Road, Sewree, Bombay 400015.

SINGLE PHASING PREVENTER

'Otronic' Single Phasing Preventer with built-in surge protector is environment-proof, according to the manufacturer The surge protector drains off over-voltage transients (surges) and enables longevity of the device. The preventer is well protected against moisture which could otherwise affect it during rainy seasons.

SINGLE PHASING PREVENTER

It is available in three types — for automatic instantaneous tripping, automatic time delayed tripping, and manual time delayed tripping with trip indication lamp. The preventer is suitable for any HP motor working on 415V, 50Hz supply.

The preventer works on zero phase sequence principle and protects the motor under no load to full load condition. Each unit withstands 2kV HT test.

Contact: Otronic, Lawyers Chamber-
Ground Floor, 18 Picket Cross Road,
Bombay-400002.

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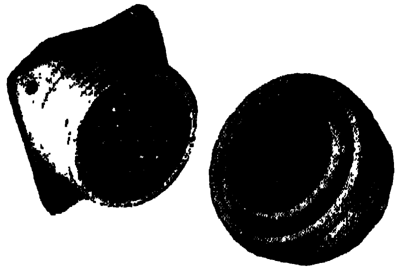
Telex : 155 497 PNRC IN

CIRCULAR CONNECTORS

Circular Connectors are primarily designed as quick release heavyduty, waterproof and high-performance connectors for electrical, electronic and machine tools industries. These connectors can withstand severe shocks and vibrations and take general rough handling. Robust corrosion resistant housings are coupled by course threads. These connectors conform generally to Joint Services Specifications (JSS 50812).


CIRCULAR CONNECTORS

Presently available are shell sizes 2, 3, 4, 5, 7, 9, 14, 16, 24, 37 & 38 poles. Present series is rated for 12 amps and 500V AC. Combination of power and control circuits is possible. Connectors for current ratings up to 100 amps and higher voltages can be developed.

Contact: Sameer Electrical Enterprises,
612-GIDC Industrial Estate,
Baroda 390010.

GAS/FUME/VAPOUR DETECTOR ALARM

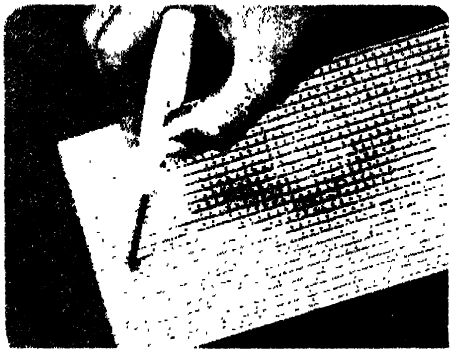
This new version of multipoint gas detection instrument detects the presence of combustible gases, LPG, gobar gas, hydrocarbons, ammonia, hexane, hydrogen, acetone, benzene, chloroform fumes, alcohol vapours, carbon monoxide, solvent vapours, methane, poisonous gases, acetylene etc. It sounds an alarm at a level which is adjustable. There is arrangement to function a maximum of four numbers of various gas detector heads at a time.

GAS/FUME/VAPOR DETECTOR ALARM

Contact: Subtronics, "Kaliandas Udyog Bhavan", 147, Near Century Bazar,
Worli, Bombay 400025.

STRIPBOARD & CUTTER

General-purpose PCB Stripboard and Cutter introduced by Fiji Electronics help to wire a circuit with convenience. At present two types of stripboards are being manufactured — one with 2.5mm pitch and the other with 3.8mm pitch. Stripboards with 3.8mm pitch are suitable for circuits using discrete devices whereas the 2.5mm pitch boards are meant for circuits using DIL type ICs.


STRIPBOARD & CUTTER

Contact: Fiji Electronics, Puthencurichy,
Trivandrum 695303.

METAL ETCHING INK

The Etching Ink can be used for identification of components made of steel and its alloys, copper, zinc, brass etc. The ink will etch the metal by 5 microns, depending upon the surface condition.

For markings a brush or felt tipped pen can be used. The etching ink can be filled in the felt pen after washing and drying the felt. After marking, it is advisable to apply a thin coating of oil to eliminate the possibility of rusting. The mark made cannot be easily erased.

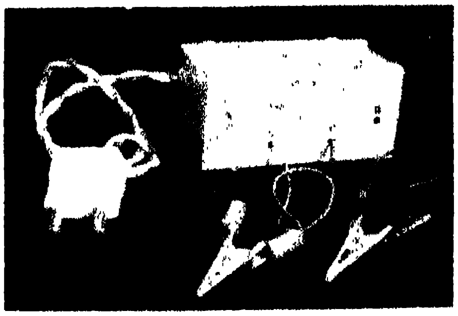
The ink is ideal for marking metal components like dies, jigs, fixtures, fabricated components or on any such materials for easy identification, especially when the items are to be stored for long periods. It is suitable for marking components undergoing heat treatment also.

Available in 200cc and 1000cc plastic containers.

Contact: Hillbrook Sales Pvt Ltd,
"Rayala Buildings", 785, Mount Road,
Madras 600002.

SEMICONDUCTOR TESTER

This low-cost Semiconductor Tester can test any type of diode or transistor, and can identify whether the transistor is pnp or npn type in a fraction of a minute. There need be no fear of damage because of wrong polarities or excessive current flow. Indication of 'good' or 'bad' device is given by the two LEDs.


SEMICONDUCTOR TESTER

This device, built in anodised aluminium housing, consumes very little power. It works on 230V AC but can be made to operate on 1.5V DC. It weighs just 100 gms, and is best suited for inhouse testing for small scale industries, teaching institutions, research labs, hobbyists etc. Price Rs 31.

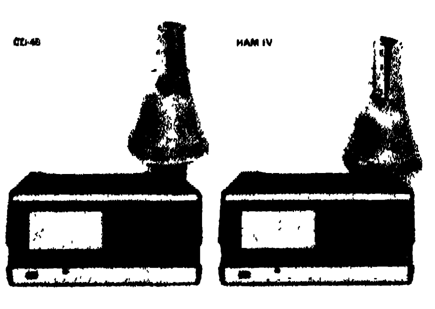
Contact: Maheshwari Electronics, 14-6-33,
Begum Bazar, Hyderabad 500012.

ANTENNA ROTATORS

Late in 1981 Telex Communications Inc., USA purchased the antenna division of CDE. With the manufacturing facility at Nebraska turning out products to be marketed in 80 countries around the world: antennas, towers, rotators, microphones and boom-mic headsets are manufactured for a wide variety of communications.

The Ham IV is designed for large communications antenna arrays, features weatherproof construction (using 98 ball bearings), automatic prebrake, accurate positional readout, and low voltage control for safe and sure operation.

Model CD 45-II is the 'engineered choice' for the serious communicator looking for professional features in a compact, economical package.



ANTENNA ROTATORS

For amateurs import is under OGL; for others Actual User licence is required.

Contact: Maxtronix, 125 B Santoshnagar Cly, Hyderabad 500659.

WATTMETER

Model 43 Thruline Directional Wattmeter of Bird Electronic Corp., USA is a portable insertion type instrument for measuring forward or reflected CW RF power flow in coaxial transmission lines under any load conditions. The wattmeter consists of a line section, an indicating meter in an aluminium case, quick-change type connector and a plug-in element. Total range of measurement is 100 mW to 10 kW in 2 MHz to 2.3 GHz, depending upon the chosen plug in element

WATTMETER

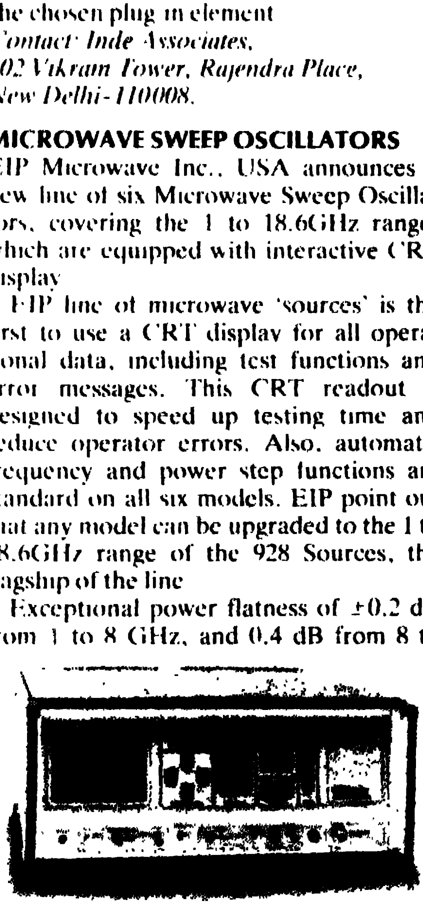
Contact: Inde Associates,
202 Vikram Tower, Rajendra Place,
New Delhi-110008.

MICROWAVE SWEEP OSCILLATORS

EIP Microwave Inc., USA announces a new line of six Microwave Sweep Oscillators, covering the 1 to 18.6GHz range, which are equipped with interactive CRT display

EIP line of microwave 'sources' is the first to use a CRT display for all operational data, including test functions and error messages. This CRT readout is designed to speed up testing time and reduce operator errors. Also, automatic frequency and power step functions are standard on all six models. EIP point out that any model can be upgraded to the 1 to 18.6GHz range of the 928 Sources, the flagship of the line

Exceptional power flatness of ±0.2 dB from 1 to 8 GHz, and 0.4 dB from 8 to 18.6 GHz is claimed by the manufacturer, with precision power levelling providing typical power flatness figures of +0.05 dB.


MICROWAVE SWEEP OSCILLATORS

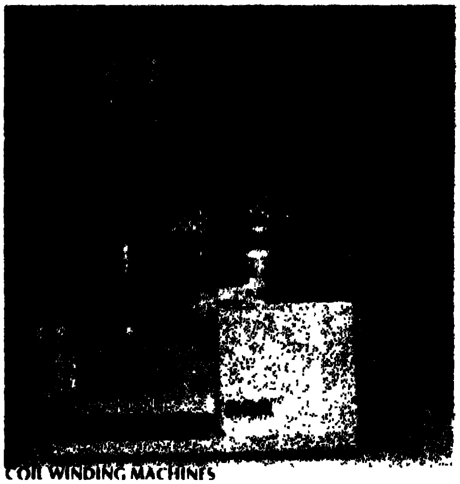
Available in India against Actual Users licence.

Contact: Trans Marketing Pvt Ltd, Sterling Centre, 16/2 Dr Annie Besant Road, Bombay 400018.

COIL WINDING MACHINES

Pushbutton start Coil Winding Machines manufactured by Eastman Industrial Co. Ltd, Taiwan are now being offered through their exclusive agents in India. Whereas model JY-1500E can take 16 to 38 AWG wires, models JY-500F and JY-50 can wind 24 to 48 AWG wires. Pitch control in all these three machines is through gear change, and they all use 1/3HP AC motors.

Some other features common to the three machines are electronic counter, electromagnetic braking, 15mm spindle, 150mm maximum winding diameter, 5 to 50mm winding width, and 115V 60Hz/220V 50Hz option. Their winding speeds are 1200/3500/6000 RPM for JY-50, 1200/3500/6000 RPM for JY-500E and 300/700/1250 RPM for JY-1500E.


COIL WINDING MACHINES

Contact: Guru Amardass International Pvt Ltd, B-197 Narain Vihar,
New Delhi - 110 028.

GAS BLOCKED TRAY CABLES

The Electronic and Industrial Cable Division of Brand-Rex Company introduces Brand-Rex Gas Blocked Tray Cable to restrict gas and vapour transmission through the cable core from hazardous areas.

The cables have undergone extensive testing to ensure product reliability. Approved for Class 1, Division 2 applications, they meet the 70,000 BTU/hr tray fire test. They are resistant to sunlight and extreme cold temperatures, and to a wide range of chemicals. Current overload protection is 135 per cent for 60 minutes, 200 per cent for two minutes.

GAS BLOCKED TRAY CABLES

The cables are also UL listed, Type TC, for 600 volts in 90°C dry locations and 75°C wet locations.

Contact: Sree Devi Enterprises, P.B. No. 5, "Devi House", E.V.R. Road, Tiruchirapalli 620021.

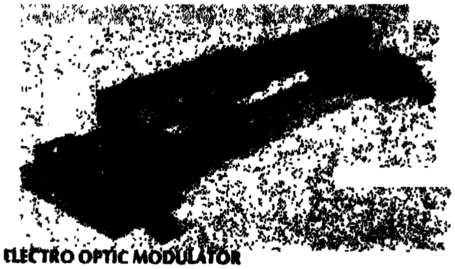
ELECTRO OPTIC MODULATOR

Series 7500 Electro Optic Modulator system for IR lasers from Rofin Ltd, UK is a single integrated modular system with 1 to 2 nanosecond rise time; small in size with no alignment problem, will modulate pulse switch and Q-switch for 10.6 μm, 5.3 μm and other wavelength from 2 to 14 micrometres.

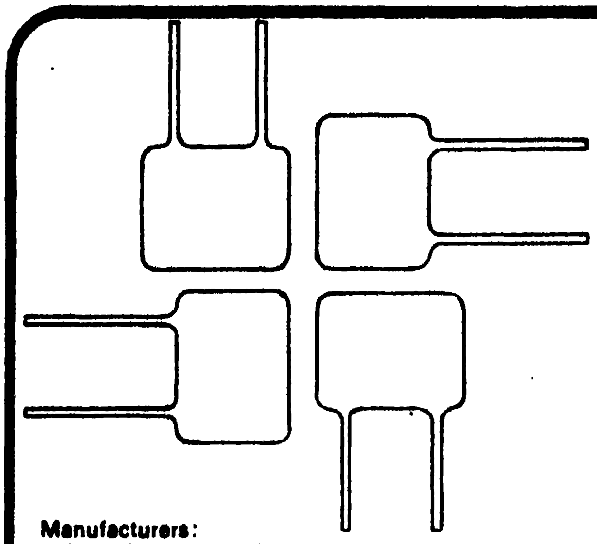
It essentially consists of a polariser made of germanium, retardation plate, beam condenser and expander made of Cd Te, which have low loss and are designed for minimum spherical aberration, and electro-optic crystals.

The alignment carriage allows the user to precisely align the whole assembly in a matter of a minute. It also consists of high voltage step generator which provides facility for Q-switching, pulse slicing, or pulse transmission mode cavity dumping.

This finds extensive use in ultrafast CO_2 laser pulse switchings, laser Q-switching and cavity dumping, modulation of continuous laser etc.


ELECTRO OPTIC MODULATOR

Contact: Toshi-Tek International,
267 Kilpauk Garden Road,
Madras 600010.



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Range	1/4, 1/2 Watts	ohms: 10 – 2.2 M.Ω

Manufacturers:
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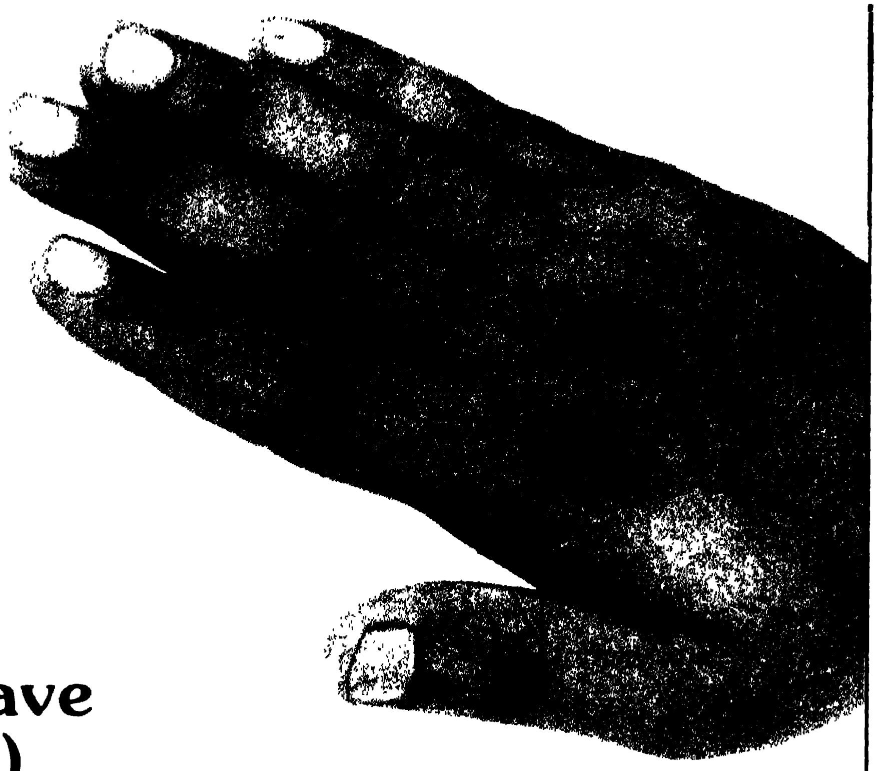

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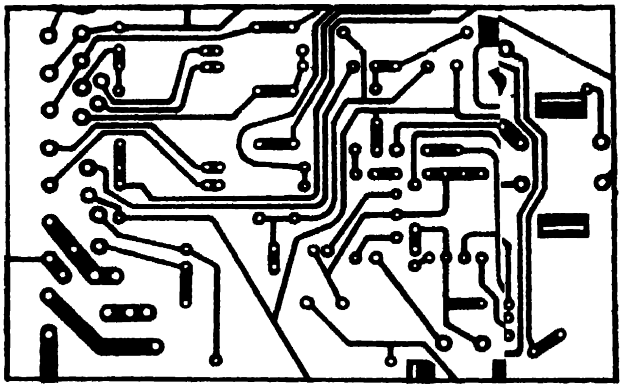


Direct all enquiries to:

Eddy Current Controls (India) Ltd..

P.B. No: 2375, XXXV/1378-3,
M.G. Road, Cochin 682 016.
Phone:32678

company profiles

J.V. Electronics to set up a new unit

J.V. Electronics Limited, a 100 per cent export-oriented firm is setting up a new unit in Gurgaon district. The firm, which has two units at Faridabad, produces mica capacitors which are used in the production of defence and telecommunication equipment and in computers.

It is a subsidiary of another 100 per cent export-oriented company — the Metores Corporation Limited — which was set up in 1974 in collaboration with Sangamo Weston Inc. of the United States.

According to Mr Om Wadhwa, chairman and managing director of J.V. Electronics, the company is thinking of diversifying into the field of I.C. sockets and other passive electronic components.

The firm exports its products to the US, the USSR, the UK, Japan, Taiwan and other industrially advanced countries. J.V. Electronics is currently executing an export order of Rs 10 million from the USSR.

The government recently allowed it to sell a small proportion of its production in the domestic market to cater for the requirements of defence and other high-technology sectors

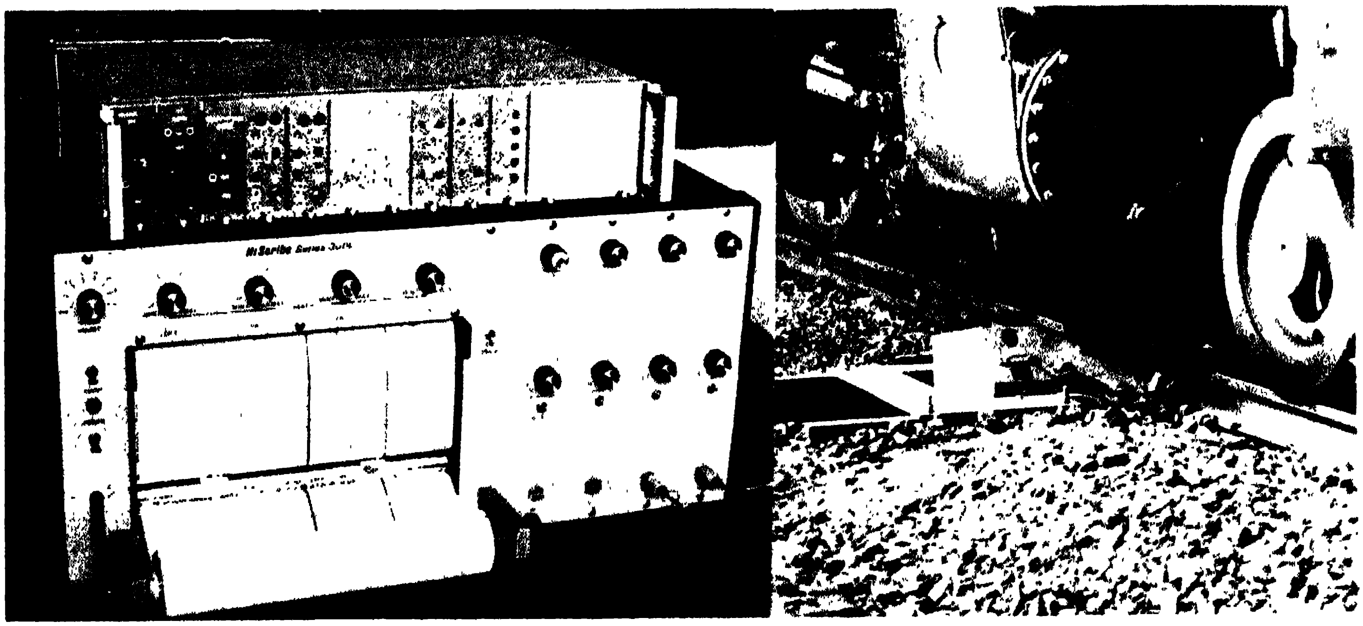
Hot box detection system developed by BEL

Bharat Electronics Limited has developed a 'hot box' detection system for the railways. The system will enable detection and identification of overheated wheel axle bearings on running trains. It will cost about Rs 500,000 as compared with Rs 700,000 for the imported one. The detection unit is intended to imporve safety in the railways as some accidents in the past have been attributed to faulty bearings.

BEL has developed the system in association with the Instrument Research and Development Establishment (IRDE), Dehradun. The initial prototype was tested at Mughalsarai in 1980. The equipment currently under trials is the final prototype-cum-engineering model.

The system consists of two infra-red sensors placed on either side of the rail tracks at a distance of up to 10 kms or more from the control room of the station and an electronic transmission and reception system, including recording facility.

As the train approaches the tracks where the scanners are placed, the shutters of the infrared scanners automatically open and heat signals from individual axles are sent to the transmitting equipment. The equipment



Left: The electronic processing and recording sub-system of the Hot Box Detection System designed by Bharat Electronics Limited. Right: The infra-red scanner (mounted on the side of the track) scanning the wheel axle bearings of a passing train for detection of Hot Boxes converts it into an electronic signal which is carried to the receiver through underground cables. The receiver at the control room patches the signal on to the recorder which gives a graphic indication of the temperature and location of over-heated axle bearings, if any.

The BEL system enables detection of hot boxes at an early stage so that preventive action can be taken. It is specially suited for super-fast trains for which distances between maintenance halts are more than average, and for heavy goods trains which do not have regular maintenance halts.

MELTRON bags a big order from AIR

Orders worth Rs 28.5 million have been received by Maharashtra Electronics Corporation Ltd (MELTRON) for the supply of professional console tape recorders and heavy-duty playback decks to All India Radio. These tape recorders would be supplied within a period of 18 months.

OSBORNE-1 Word processing systems

OSBORNE-1 is India's first truly low-cost and portable, microprocessor based word processing system. It was launched in the USA, in 1981 by Dr Adam Osborne and it soon became a bestseller, competing with such well established rivals as Apple, Radio-shack and IBM. Sterling Electronics Pvt Ltd, Madras has obtained a licence to manufacture these systems in India on components purchase basis only and will soon start assembly in Madras. Arya Projects Ltd, Bombay is the principal marketing agent for OSBORNE-1 in India.

KSEDC to manufacture telecommunication equipment

The Kerala State Electronics Development Corporation (KSEDC) has been granted a letter of intent for the manufacture of telecommunication equipment. This has been done under the advice of the Department of Electronics. The Ministry of Communication had been against this move because in its view, the Indian Telephone Industries (ITI)—a public sector undertaking—with its complement of several thousand engineers was best suited to manufacture telecommunication items. KSEDC will manufacture the Electronic Rural Automatic Exchange (ERAE) which would be extensively used in the extension of telecommunication to rural areas.

Kothari Electronics taps the capital market

Kothari Electronics and Industries Ltd entered the capital market on March 14, 1983, with a public issue of 700, 000 equity shares of Rs 10 each for cash at par.

The issued capital is Rs 23.4 million, out of which Rs 15.5 million is paid up. The present issue is for shares worth Rs 15 million. Shares worth Rs 8 million are offered to non-resident Indians, employees and business associates and to shareholders and deposit holders of the company. The remaining equity shares worth seven million rupees have been offered to the public for subscription.

The company set up its first project in 1980 to manufacture carbon film resistors and reached the rated capacity of 100 million resistors per annum, Simultaneously, another project was set up to manufacture annually 30,000 water activated batteries. Both the units are located at Maraimalainagar in Tamil Nadu. The third project for the manufacture of three million professional grade polystyrene capacitors was established in Hosur (Tamil Nadu) in collaboration with Arcotronics Italia, S.P.A., Italy. This plant went into production in May, 1981 and has already exported about 100,000 capacitors to the collaborators.

The company is setting up a new and large project at Hosur for the manufacture of 50 million pieces of metallised plastic film capacitors in box configuration and 3 million pieces of AC polypropylene capacitors in technical collaboration with Acrotronics. The raw materials comprising electrical grade metallised polyester, metallised polypropylene film, tinned copper wire, special quality polypropylene containers and epoxy resin, will be procured from Arcotronics for the first five years or from other alternative sources.

The cost of the project is estimated at Rs 118 million.

Konark TV makes rapid progress

The Orissa state-owned Konark Television is expected to become one of the largest manufacturers of television sets in this country next year. Its annual installed capacity by then is expected to rise to 40,000 sets. The state government is confident of getting a licence for increasing the capacity shortly.

Konark TV had started functioning as a small-scale unit under the Orissa Small Industries Corporation but is currently rated as a medium-sized unit. The turnover in 1982-83 is expected to exceed Rs 80 million—double of the level attained in 1981-82. The profit during 1982-83 will be around Rs 3 million against Rs 1.7 million in the previous year. It wiped out its accumulated loss of Rs 2.3 million in 1979-80 and now has accumulated a profit of Rs 7 million.

The production of this unit is estimated to be 16,000 black-and-white TV sets and 5000 colour TV sets during 1982-83, which puts it in the exclusive club of the top six production units in this country. The installation of a transmitter at Bhubaneswar, which is linked with the national hook-up, has given a push to the demand for Konark TV sets. The production level of black-and-white TV sets could be improved but for the current shortage of TV tubes.

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Peico dividend at 18 per cent

Peico Electronics and Electricals Ltd has recommended a final dividend of 10 per cent for 1982, which together with the interim of eight per cent will make a total dividend of 18 per cent, payable on increased capital of Rs 216 million. Last year also the dividend was 18 per cent, but on old capital.

Sales for the year were Rs 1805 million, indicating an increase of 21.3 per cent. Gross profit before tax for the year, after charging Rs 37.1 million for depreciation and Rs 51.8 million for interest, amounted to Rs 113.3 million against Rs 183.3 million for the previous year.

After making adjustments, the profit available for appropriation is Rs 63.7 million against Rs 63 million. The profit for the year before tax was 6.3 per cent of sales compared to 12.3 per cent for 1981. The dividend will absorb Rs 38.9 million against Rs 32.4 million.

Keltron Centre selected for UNDP programme

The Electronics Research and Development Centre (ERDC) of Keltron at Trivandrum has been selected by the Electronics Commission as the southern regional centre for a UNDP-aided programme on promotion of appropriate automation techniques in the energy sector.

Three other centres — Delhi, Ahmedabad and Calcutta — have also been selected for the appropriate automation promotion programme (AAPP) for evolving appropriate automation techniques in different sectors of the national economy.

The Trivandrum centre will concentrate on the energy sector and develop appropriate automation equipment needed for thermal, nuclear and hydel plants.

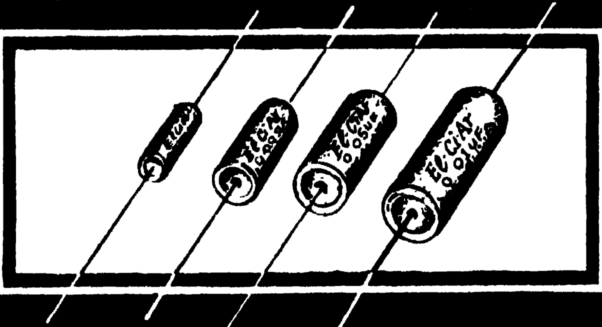
Dr V.P. Bhatkar, the project coordinator, who was also instrumental in setting up the AAPP laboratory in Delhi, is of the view that the object of promoting these techniques in the energy sector is "to achieve better power output and conserve energy inputs, improve efficiency of operation and enhance safety of workers." The whole aim is to achieve better "productivity linked to quality and safety." This is very important because of the energy crisis and the need to improve the efficiency of operation of power plants.

New electronic teleprinter developed by Tata Burroughs

Tata Burroughs Ltd has developed an advanced electronic teleprinter at its Santa Cruz Electronic Export Processing Zone (SEEPZ) plant.

The machine can be used for transmitting and receiving messages in Devnagari and English via communication channels such as telex.

With a proper interface the device could be utilised as an automatic terminal for any computing system.



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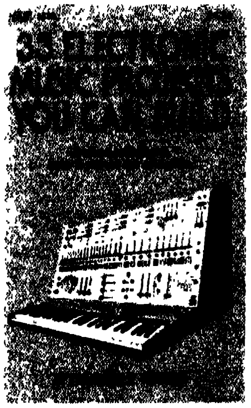
book reviews

33 Electronic Music Projects You Can Build

By Lawrence E. Winston; published by Tab Books Inc., USA, 1981; first edition—first printing; 181 pages (21 cm x 13 cm); soft cover; price $ 6.95.

Do music and electronics make a compatible combination? Can art and science be married? An answer to both these questions is provided in this book.

The musicians have been making use of electronics in order to give new dimensions to their music. And it all started with the radio (in the 1930's) which played music records on the air.



This book starts with the elements of electronics and goes on to show how it had produced a tremendous impact on music through broader frequency ranges and increased versatility of music organs.

It is essentially a Do-It-Yourself book devoted to electronic project building with emphasis on music and accoustics. The music projects included are guitar headphone amplifier, electronic metronome, integrated circuit metronome, one-transistor mixer, four-channel IC mixer, guitar volume control, musical instrument tone control, general-purpose amplifier, simple electronic organ, and IC tone generator.

In fact, the list of musical circuits included is vast. Some are very simple though there are a few which are highly complex. It is the claim of the author that "no single circuit should present an economic problem for the builder nor a technical one if all instructions are followed and schematic diagrams are closely adhered to."

For Indian hobbyists, it is necessary to ascertain if all the components needed for a project are available from the local market. The absence of even one small component can prove critical.

Regarding the presentation of the subject, the author needs to be congratulated because he has in fact done a competent job with the assistance of clear diagrams and drawings.

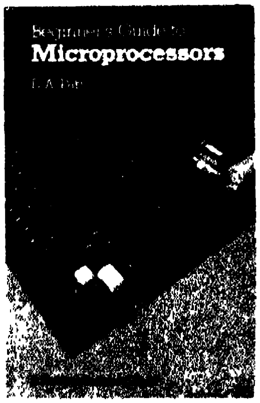
Beginner's Guide to Microprocessors

By E.A. Parr; a Newnes technical book, © Butterworth & Co. (Publishers) Ltd, 1982; pages 218 (18.5 cm x 12 cm); soft cover; price £ 3.95.

With the advent of microprocessors, the use of computers (or minicomputers) has spread to almost every sector of the economy in industrially advanced countries. Our country is slowly falling in line.

But what is a microprocessor ? According to Mr Parr, "a typical microprocessor is a 40-pin integrated circuit package containing the elements of the CPU in a computer." And that is why the book under reference lays emphasis on the integrated circuit which is the base for the microprocessor, and is explained in Chapter 2.

As is well known, a computer works in binary, i.e. it recognises either 0 or 1. Most of the microprocessors work with 8-bit data words and 16-bit addresses. The language of the microprocessor is explained systematically and the student is introduced to software and programming in Chapter 3.



The computer does not work in isolation. It has to communicate with the outside world for which purpose it utilises printers, VDUs, keyboards and other devices known collectively as peripherals. Chapter 4 is devoted to a description of the peripherals.

The microcomputer is used mostly for the control of equipment. But this control has a wide spectrum — from control of large industrial processes to controlling a washing machine or kitchen oven. The subject of microcomputer in control is covered in Chapter 5.

There are only four families of 8-bit microprocessors which dominate the market today; they are: 6502, 8080, 6800, and Z-80. Collectively, they constitute 95 per cent of the market for microprocessors. Mr Parr believes that different microprocessors have different advantages and disadvantages. While there can be difference of opinion among the experts regard-

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ing a certain computer system, it is necessary to study a few microprocessors closely. Chapter 6 deals with microprocessor families such as Motorola 6800, Intel 8080, Zilog Z-80 and certain less common devices such as Mullard/Signetics 2650, National Semiconductor SC/MP, Intersil/IM 6100 etc.

The last but one chapter deals exclusively with the applications of microcomputers such as robots, industrial control, word processors, home computer, small business computer etc. The author points out that "robots and microprocessors have become linked in most people's minds". The number of robots in the world is around 10,000 and they are not going to replace human power altogether. It is a mis-conception and a folly that robots will ultimately make human beings redundant.

The book is written in an interesting style and the author attempts a forecast about the future of the microprocessor in the last chapter. He concedes that there would be "some adverse effects on society but the boons are tremendous." In another generation, he feels, "life without the microcomputer will be equally unthinkable."

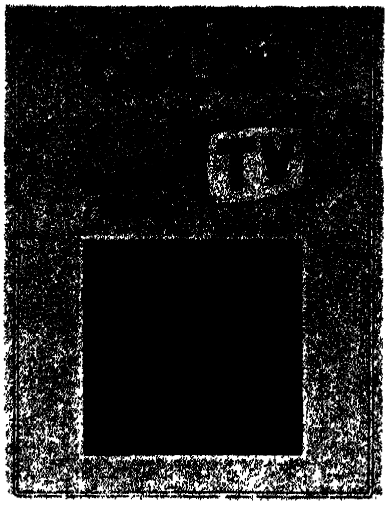
Colour-TV Training Manual

By the Howard W. Sams editorial staff; published by D.B. Taraporewala Sons & Co. Pvt. Ltd, 210 Dr Dadabhai Naoroji Road, Bombay 400001, by arrangement with Howard W. Sams & Co., Inc, USA; first Indian reprint 1982; pages 232 (27.5 cm x 21 cm); soft cover; price Rs. 125.

The first Indian reprint of this book appeared in 1982, though the American editions appeared in 1955, 1965, 1970 and 1977.

The book starts with a description of colorimetry — the science and practice of determining and specifying colours. The subject is also related with human vision which has certain deficiencies such as "the luminosity response of the eye to various colours, intensity and time thresholds, contrast limitations, and the visual-angle requirements."

The composite colour signal contains a luminance, chrominance, burst, horizontal sync and vertical sync signal. All these are explained in chapter 2.



The authors move on to the make-up of the colour picture signal in Chapter 3. It is made clear as to how the individual signals are formed and what each signal consists of. The mixing proportions of the signals that combine to form the colour picture signal are given a detailed treatment.

RF and IF circuits and monochrome circuits are dealt with in chapters 4 and 5. Each concept is explained with the assistance of diagrams and pictures.

Bandpass-amplifier, colour-sync and colour-killer circuits are given in chapter 6. Then, the authors discuss the two types of modulation that are present in the chrominance signal. It is the function of the matrix section to combine the luminance signal and the colour-difference signal.

Having explained all these elementary ideas, the authors take up a discussion of the colour picture tube and associated circuits, and go on to the procedures to be adopted for servicing the colour receiver.

This book constitutes a training manual and can be understood clearly with the help of a competent teacher. It can also serve as a good refresher course for those who are not totally new to this subject.

A drawback of the book is that having been produced in America, it assumes NTSC system of colour TV transmission and reception while dealing with the subject, whereas PAL is the system in use in India.

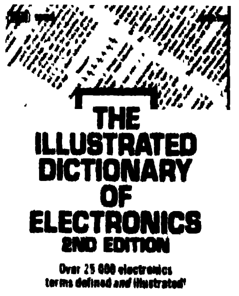
The Illustrated Dictionary of Electronics

By Rufus P. Turner; published by Tab Books Inc., USA, 1982; second edition —first printing; 893 pages (21 cm x 13 cm); soft cover; price $ 16.95.

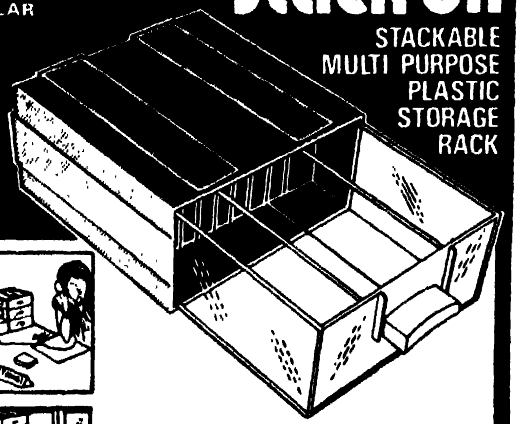
This is a comprehensive dictionary of technical terms with more than 25,000 definitions and 482 detailed drawings and diagrams.

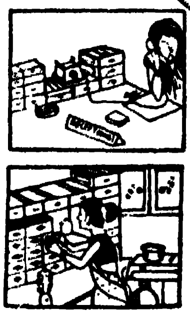
It is a dictionary and not an encyclopaedia; each term is defined in very precise and clear words.

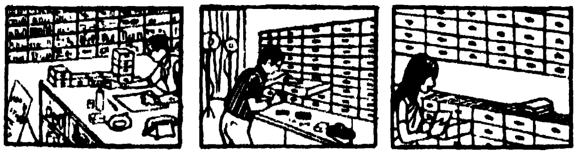
The author combines in himself two virtues. First, he holds a Ph.D. in English and second, he is a licensed professional engineer. This unique combination of the two disciplines makes him pre-eminently suitable for the assignment.



Understandably, the field covered is wide and any word which has a possibility of being used in electronics books or by electronics engineers is included. For instance, the expression 'escape velocity' has very often been used in space research and not in electronics, but it is included in the present dictionary. It defines 'escape velocity' as the minimum velocity required for a body such as a rocket to escape the gravitational pull of earth or of another heavenly body.







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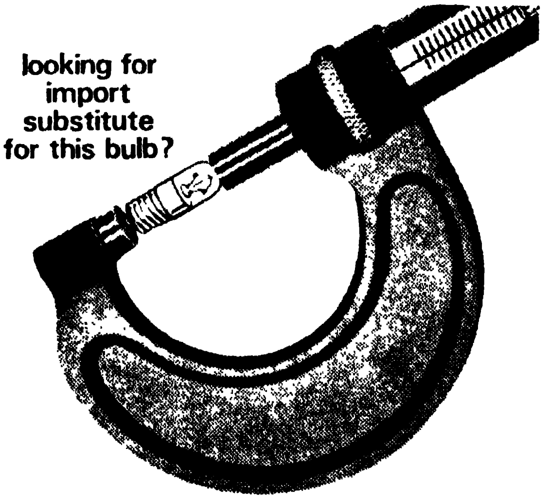

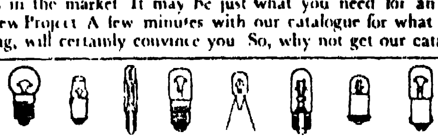

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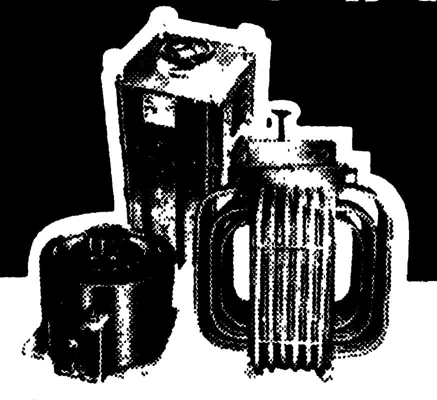

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The following licences and letters of intent were issued to electronics firms under the Industries (Development & Regulation) Act, 1951 during the months of November & December 1982.

Name & Address of the Applia[illegible] and location of the undertaki[illegible]	*Date & type of licence*	*Article*	[illegible] *annum*
(1)	*(2)*	*(3)*	*(4)*
LICENCES			
Bharti Cutler 1161 New Dell New Delhi. (Distt Gurgaon - Haryana)	3.11.82 (SE)	1. Contactors	175,000 nos. (annual cap. after expn)
		2. Relays	200,000 nos. (annual cap. after expn)
		3. Push buttons	2 million nos. (annual cap. after expn)
		4. Limit switches	50,000 nos. (annual cap. after expn)
		5. Special panels	1000 nos. (annual cap. after expn)
Maharashtra Electronics Corpn Ltd. Plot No. 214, Backbay Reclamation, Raheja Centre, 13th Floor, Nariman Point, Bombay. (Distt Nagpur - Maharashtra)	9.11.82 (NU)	Two-way radio communication and allied equipment	Ex-factory turnover value of Rs 30 million (to be reviewed after 5 years or earlier if the turnover limit has been reached).
HMT Limited (Watch Div.) Electronic Watch Project, 10/5 Kasturba Gandhi Road, Bangalore. (Kamprup Distt - Assam)	24.11.82 (NU)	Miniature button type battery cells	3 million nos.
Meltron Instrumentation Ltd Plot No. 214, Backbay Reclamation, Raheja Centre, 13th Floor, Nariman (Distt Ratnagiri - Maharashtra)	20.12.82 (NU)	1. Dynamic crack detectors 2. Ferrous segregators 3. Magnetic particle detectors 4. Ultrasonic gauges	50 nos. 100 nos. 100 nos. 200 nos.
[illegible] Multicore Solder (P) Lt[illegible] [illegible] Road, [illegible] Town, (Distt Bangalore - Karnataka)	21.12.82 (NU)	1. Flux cored solder and solder products 2. Soldering fluxes	250 tonnes 30 tonnes
Electronic [illegible] (P) Ltd [illegible] Old Madras Road, [illegible] No. [illegible], Bangalore, (Karnataka)	27.12.82 (COB)	1. Video terminals 2. Programmable calculators (excluding A/c & Invoicing machines, Personal computers, Word processors and Small business systems)	75 nos. 45 nos.
LETTERS OF INTENT			
[illegible] Cables Ltd [illegible]	2.11.82 [illegible]	PCM multiplex equipment	500 terminals
[illegible] Corpn Ltd [illegible]	[illegible].11.82 [illegible]	Digital transmission equipments [illegible] terminals	500 terminals

(1)	(2)	(3)	(4)
Uptron Digital Systems Ltd Talab Tikait Rai, Aishbagh, Lucknow. (Lucknow - Uttar Pradesh)	2.11.82 (SE)	1. Key to disc data entry systems 2. Intelligent terminal	75 systems (exis.) 150 systems (after expn) 150 systems (exis.) 300 systems (after expn)
Punjab Communications Ltd C-30 Phase-II, Industrial Focal Point, S.A.S. Nagar, Mohali, Punjab. (Distt Ropar - Punjab)	2.11.82 (NA)	Multichannel radio relay systems	100 nos.
Indian Telephone Industries Ltd 16, Museum Road, Bangalore. (Gonda - Uttar Pradesh)	4.11.82 (NU)	Electronic digital switching equipment	500,000 lines
The Orissa State Electronics Development Corpn Ltd 289, Sahidnagar, Bhubaneswar. (Distt Puri - Orissa)	6.11.82 (NU)	Magnetic tapes (audio) of 6.35 mm	2400 MRPI
Gujarat Industrial Investment Corporation Ltd Chunibhai Chambers, Behind Dipali Cinema, Ashram Road, Ahmedabad. (Gujarat - Backward Distt)	6.11.82 (NU)	Audio magnetic tapes	1000 MRM in terms of 6.35mm width
Usha Rectifier Corpn India (P) Ltd 12/1, Mathura Road, Faridabad. (Haryana - Backward Distt)	9.11.82 (NU)	Connectors comprising the following types: 1. Printed circuit board 2. Rack and panel 3. Radio frequency 4. Round shell	1 million nos.
Hindustan Conductors Pvt Ltd 24, Sayed Abdulla Brelvi Road, Fort, Bombay (Gujarat - Backward Distt)	9.11.82 (NU)	1. Carbon film resistors 2. Metal film resistors	300 million nos. 200 million nos.
Bharat Heavy Electricals Ltd 18-20 Kasturba Gandhi Marg, New Delhi. (Bangalore - Karnataka)	9.11.82 (NA)	1. Solar cells 2. Photovoltaic systems	30,000 nos. 250 kW
Anika Computers (P) Ltd 24, Housing Society, NDSE (I), New Delhi. (Gurgaon - Haryana)	12.11.82 (NU)	1. Computer peripherals (intelligent and interactive graphic terminals) 2. Integrated systems for testing photovoltaic solar cells and solar panels 3. Powerline monitoring systems	200 complete systems 100 complete systems 40 complete systems
British Physical Laboratories India Ltd Bangalore (Distt Bangalore - Karnataka)	12.11.82 (NU)	Video deck for betamax and HVS systems	50,000 nos.
G.V.N. Raju (Technocrat) 6/6 Primrose Road, Richmond Town Post, Bangalore. (Karnataka - Backward Distt)	16.11.82 (NU)	Miniature button lithium batteries	1.2 million nos.
K.N. Tiwari, Managing Director The Orissa State Electronics Development Corpn Ltd 289, Sahidnagar, Bhubaneswar. (Distt Puri - Orissa)	23.1.82 (NU)	Metallisation on 1. Polyester film 2. Polypropylene film 3. Polycarbonate film	150 tons
Electronics Corpn of India Ltd Industrial Development Area, Cherlapalli, Hyderabad (Distt Chittor - Andhra Pradesh)	26.11.82 (SE)	Metal film resistors	10 million nos. (exis.) 35 million nos. (after expn)
Rajasthan State Indl Dev and Investment Corpn Ltd Udyog Bhavan, Tilak Marg, Jaipur. (Rajasthan - Backward Distt)	26.11.82 (NU)	Printed circuit boards	10,000 sq. mtrs
Orissa State Electronics Development Corpn Ltd 289, Sahidnagar, Bhubaneswar. (Orissa - No Industry Distt)	26.11.82 (NU)	Audio tape recorders and combination thereof with radio	60,000 nos.

(1)	(2)	(3)	(4)
Sahney Kirkwood Private Ltd 27, Kirol, Vidyavihar (West), Bombay. (Nasik - Maharashtra)	30.11.82 (SE)	Mica based insulating materials	240 tonnes (exis.) 490 tonnes (after expn)
British Physical Laboratories India Ltd M.G. Road, Post Box No. 5194, Bangalore. (Distt.Palghat - Kerala)	30.11.82 (SE)	Electrocardiographs	1000 nos. (exis) 2500 nos. (after expn)
Industrial Promotion and Investment Corporation of Orissa Ltd. (A Govt. of Orissa Undertaking) IPICOL House, Janpath, Bhubaneswar. (Distt Puri - Orissa)	17.12.82 (NU)	Hard ferrites	1200 tonnes
The Orissa State Electronics Development Corpn Ltd 289, Sahidnagar, Bhubaneswar (Orissa - No Industry Distt)	21.12.82 (NU)	Printed circuit boards	20,000 sq. mtrs
The Delhi Cloth & Gen. Mills Co. Ltd Unit: DCM Data Products Shivaji Marg, New Delhi. (New Delhi)	24.12.82 (NA)	Printed circuit boards	100,000 nos.
Bharat Electronics Ltd Trade Centre, 29/4, Race Course Road, Bangalore. (Distt Meerut - Uttar Pradesh)	24.12.82 (SE)	1. Sophisticated electronic equipment 2. Radar and microwave communication equipment	187.5 million (exist.) 400 million (after expn)
Andhra Pradesh Electronics Development Corpn Ltd 5th Floor, Parisrama Bhavan, Basheer Bagh Square, Hyderabad. (Andhra Pradesh)	31.12.82 (NU)	Picture tubes for colour TV receivers	500,000 nos.
Hindustan Conductors Pvt Ltd 24, Syed Abdullah Brelvi Road, Fort, Bombay. (Gujarat)	31.12.82 (NU)	Aluminium electrolytic capacitors	100 million nos.
Balkishan Agarwal D Block, Highway Apartments, 2nd Floor, Sion, Bombay. (Maharashtra)	31.12.82 (NU)	Audio magnetic tapes (width 6.35 mm)	1000 MRM
Asian Cables Corpn Ltd Nirmal, Nariman Point, Bombay. (Goa, Daman and Diu)	31.12.82 (NU)	Jelly filled solid foam and skin foam polyethylene insulated telephone cables	500,000 cores km
Lakhanpal National Ltd Makarpura Industrial Area (GIDC), Baroda. (Uttar Pradesh)	31.12.82 (SE)	Dry battery cells	30 million nos.
Wipro Products Ltd, Bakhtawar, 14th Floor, 229, Backbay Reclamation, Bombay. (Karnataka)	31.12.82 (NA)	1. Winchester disc drives 2. Dot matrix printer 3. High-speed dot matrix printer with graphics 4. Letter quality dot matrix printer	1000 nos. 1000 nos. 1000 nos.
Hindustan Conductors Pvt Ltd 24, Sayed Abdulla Brelvi Road, Fort, Bombay. (Gujarat)	31.12.82 (NU)	1. Ceramic capacitors 2. Ceramic discs	150 million nos. 150 million nos.
Kamaljit Singh Sood, C-49 Kalkaji, New Delhi. (Uttar Pradesh)	31.12.82 (NU)	Ceramic chip capacitors and leaded derivatives	150 million pcs
Punjab Electronic Components Ltd A-28, Phase VII, Industrial Estate, S.A.S. Nagar, Near Chandigarh. (S.A.S. Nagar, Punjab)	31.12.82 (NU)	1. [illegible] 2. Hard ferrites 3. Permanent magnets	500 tonnes 500 tonnes 100 tonnes
Dr L.S. Kanodia and A.R. Cooper 15, Eden Hall, Worli, Bombay. (Gandhinagar - Gujarat)	31.12.82 (NU)	Electronic printed circuit boards	10,000 sq. meters
Teletube Electronics Pvt Ltd D-34 & 35 Sector 27, Kavi Nagar Industrial Area, Ghaziabad ([illegible] Pradesh)	31.12.82 (SE)	Black and white TV picture tubes	100,000 tubes (exis.) 200,000 tubes (after expn

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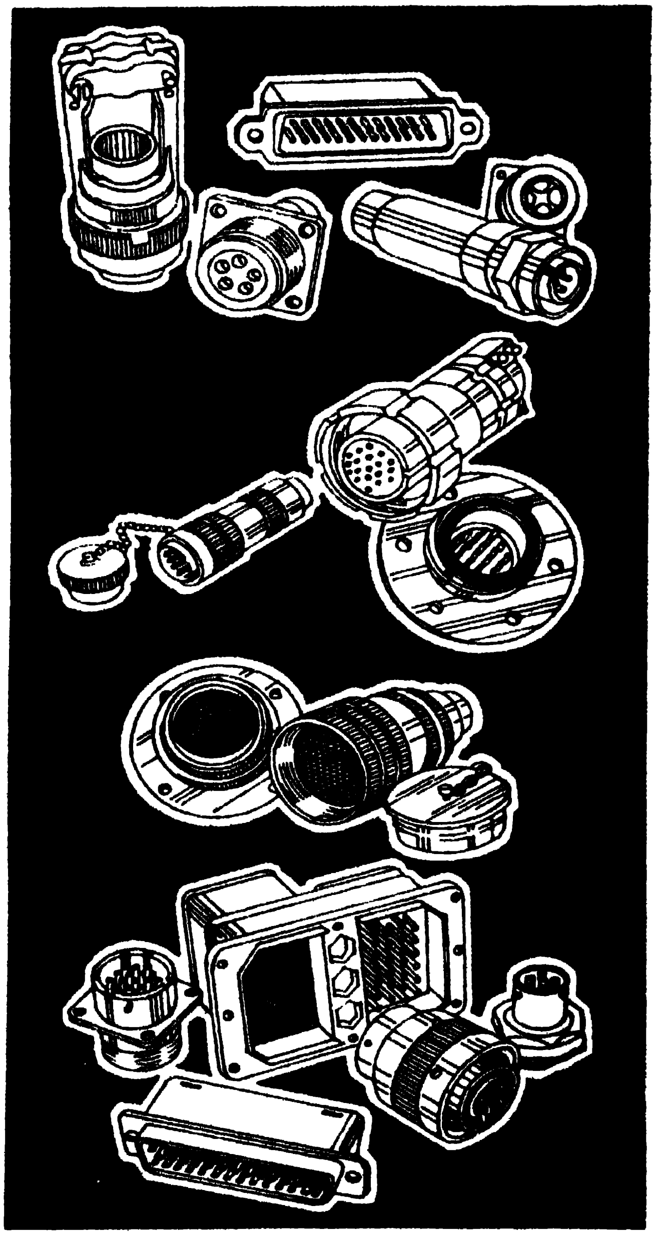

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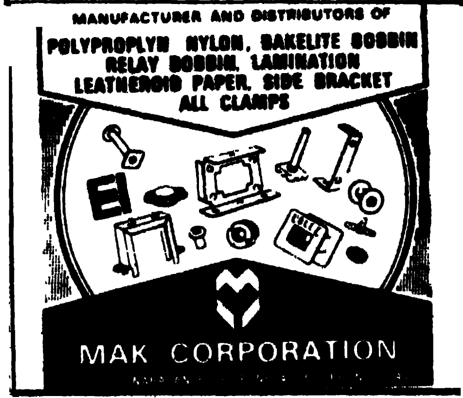
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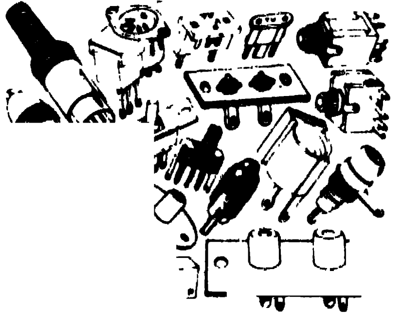

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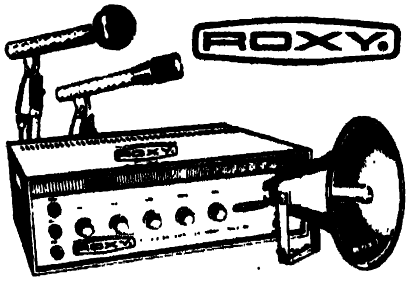

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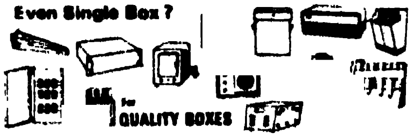

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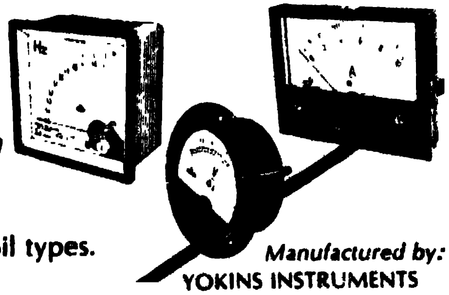

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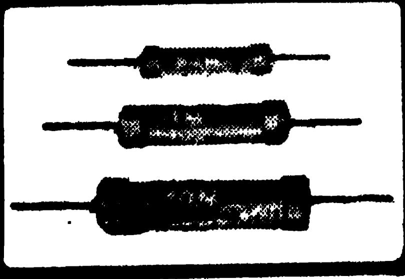

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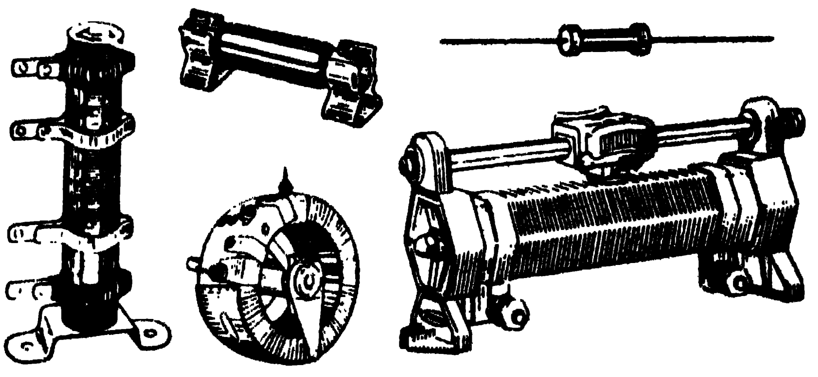

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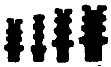

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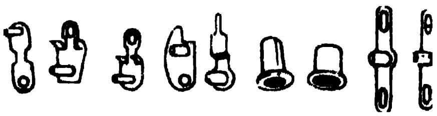

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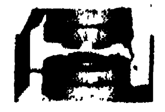

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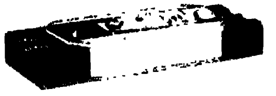

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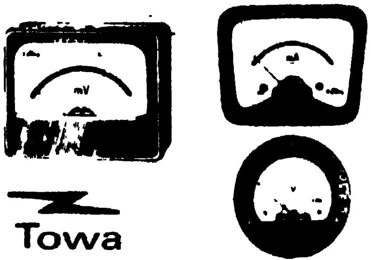

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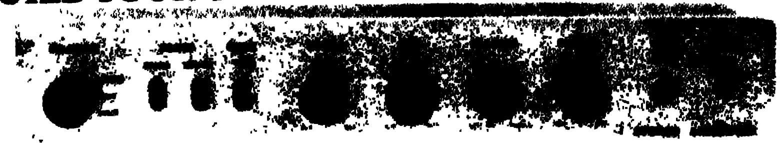

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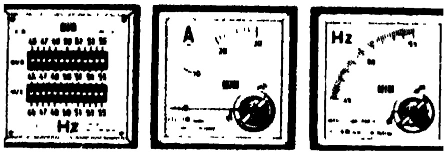

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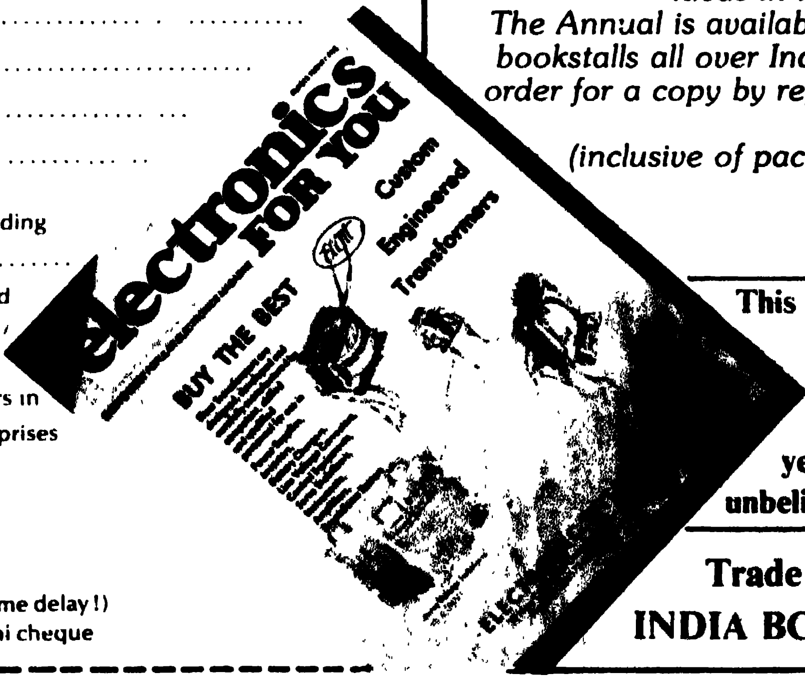

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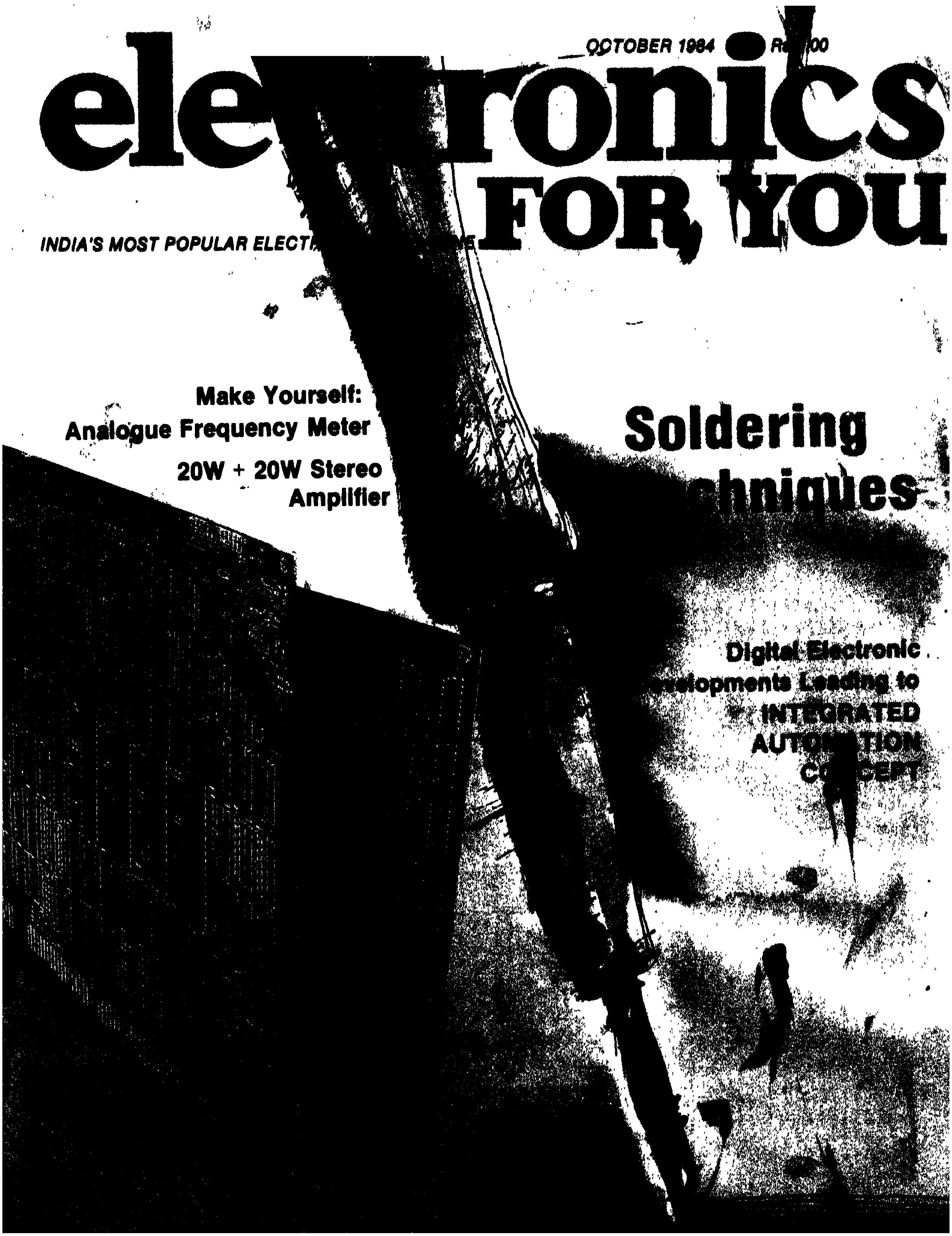

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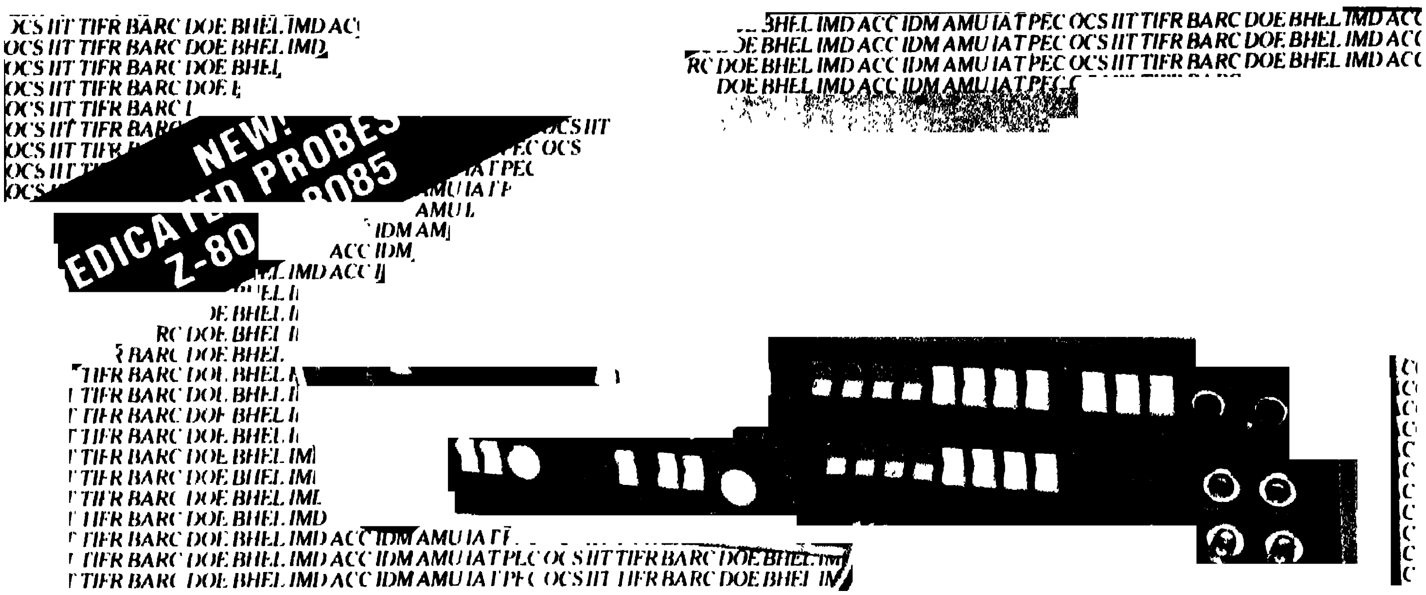

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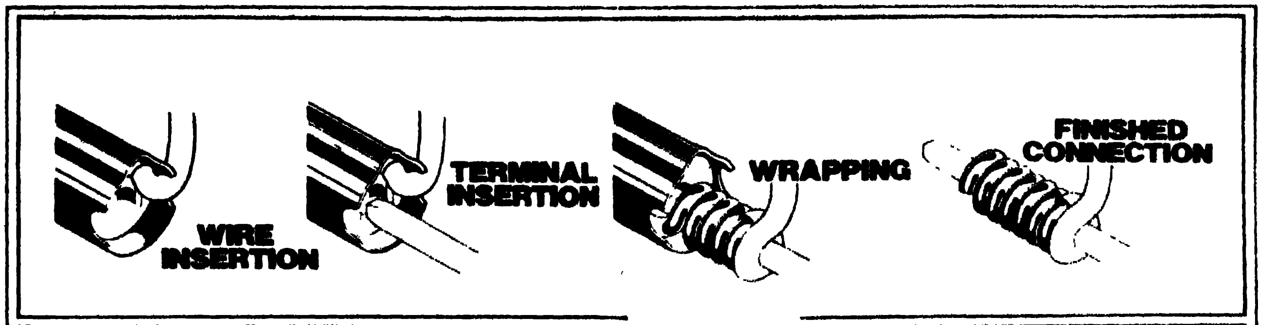

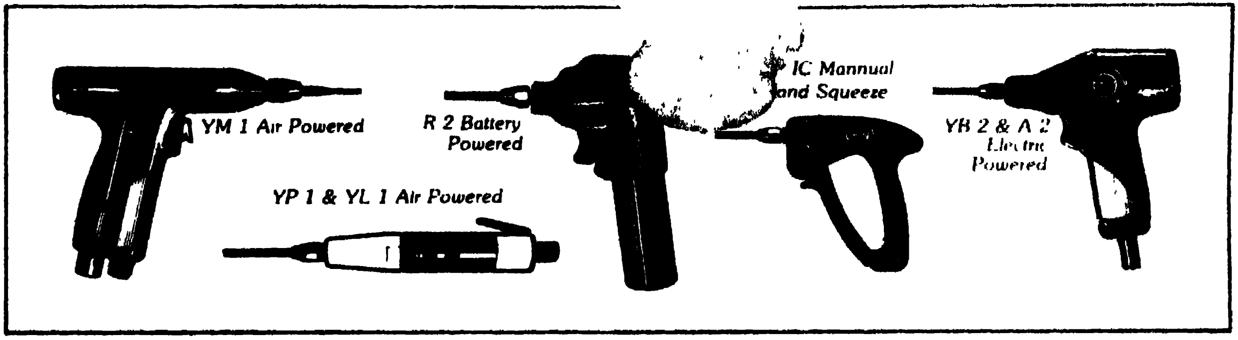

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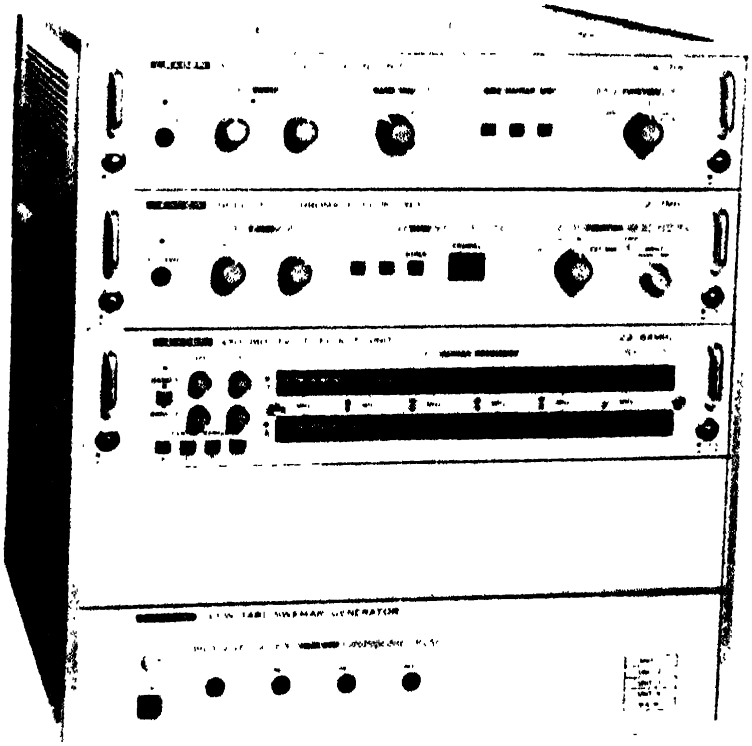

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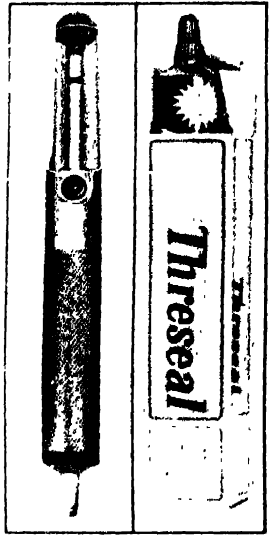

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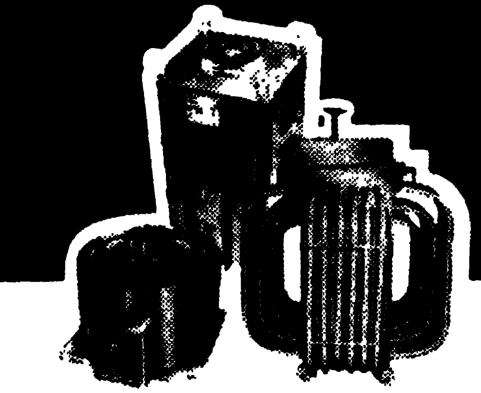

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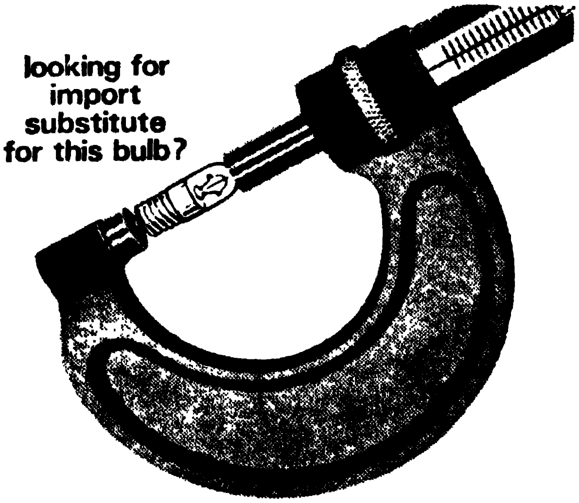

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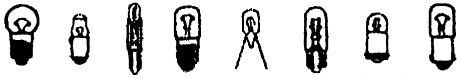

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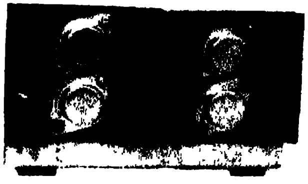

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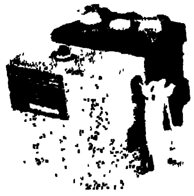

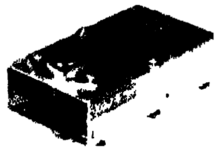

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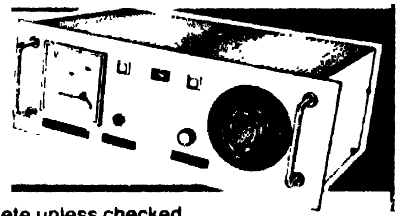

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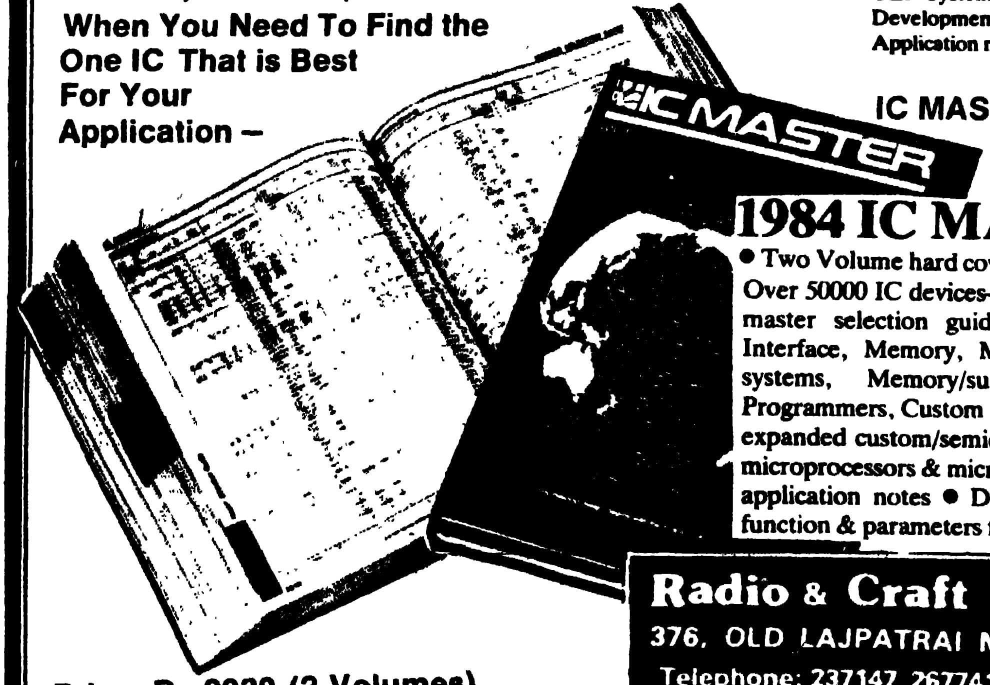

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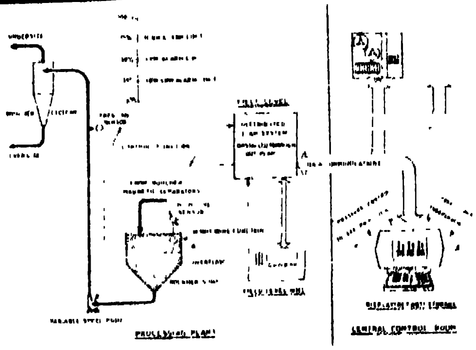
Digital Electronic Developments Leading to Integrated Automation Concept 19

Jayanta Chatterjee

The new developments in digital electronic techniques have led the manufacturers to adopt an integrated solution for process machine automation. This process called ICAM or integrated control automation monitoring system, has been discussed in this article, with reference to its application areas in India.



Soldering Techniques 27

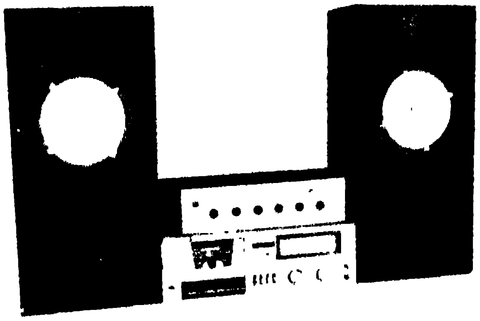
K. Venkatesan

The soldered joint is a very important part of any electronics project. The increased miniaturisation along with expensive components necessitates a study of soldering techniques in all its aspects. Here is an in-depth study of various soldering techniques, with special emphasis on hand soldering.

20W+20W Stereo Amplifier 61

S. Srinivasa Murthy

A stereo amplifier is one of the most popular projects for an electronics hobbyist and the professional alike. The amplifier described here can be used with tuner, tape-deck, record player and electronic musical instruments. This project costs less than a thousand rupees, including the speaker system.



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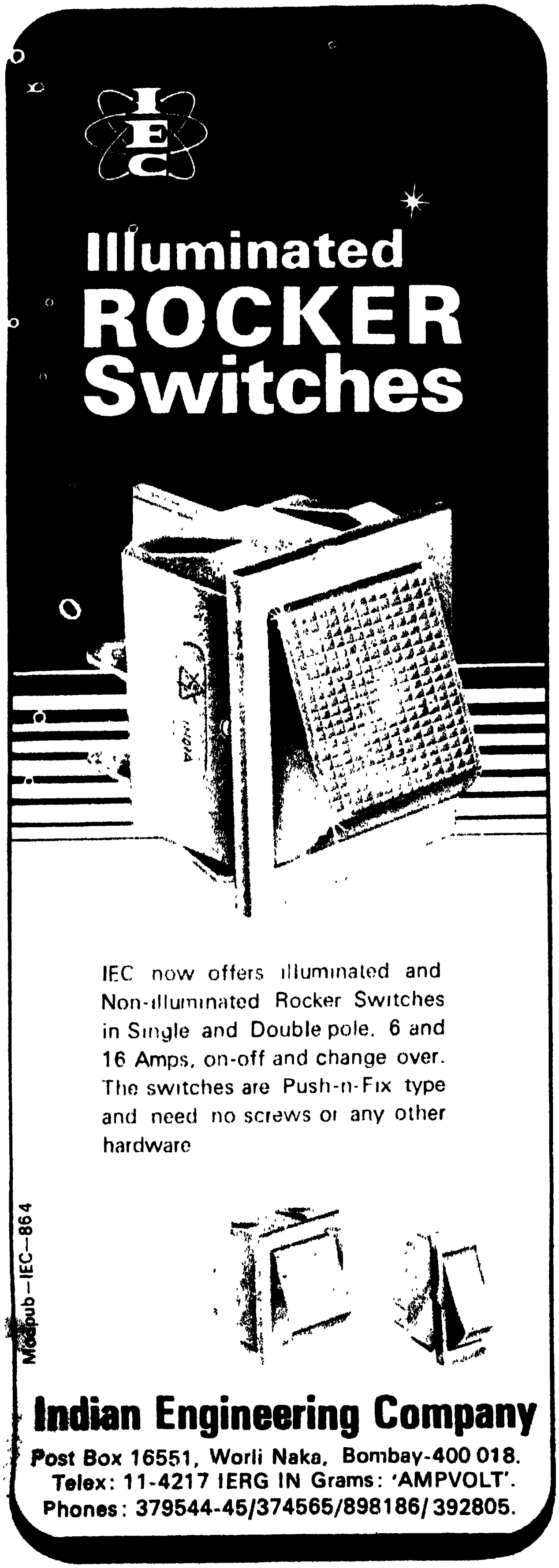

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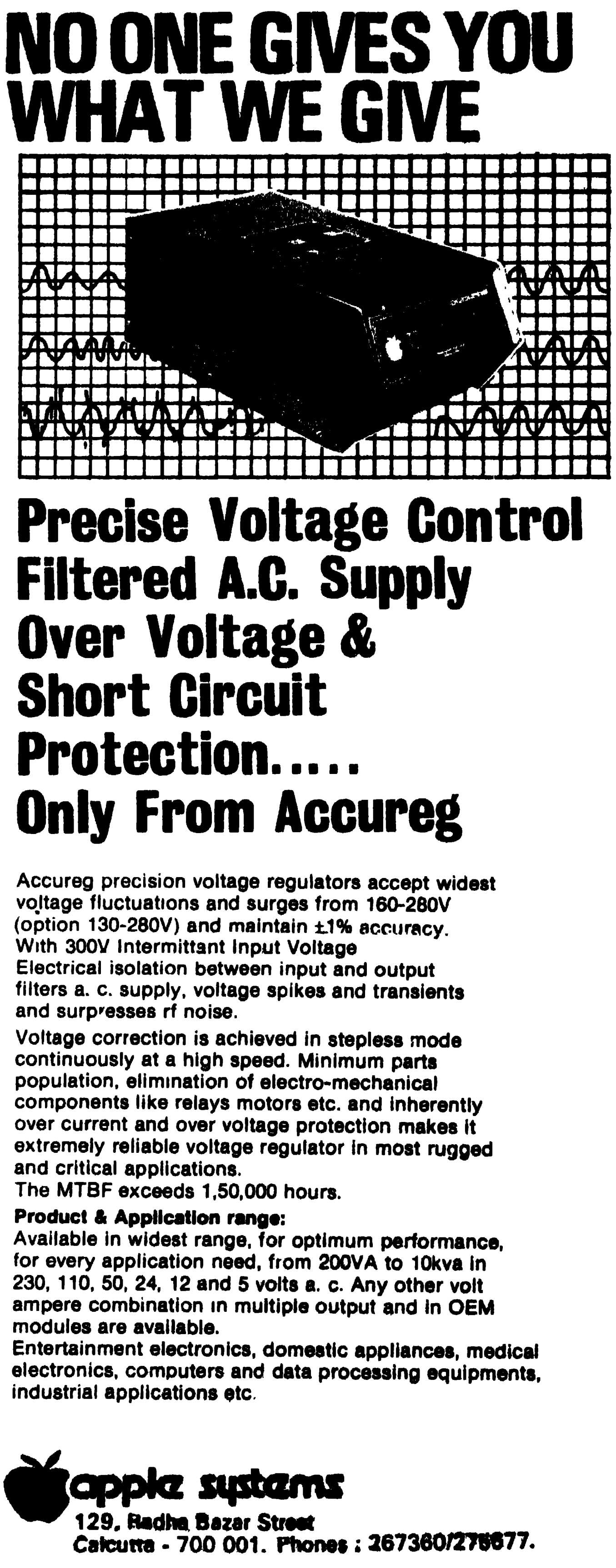

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LETTERS

SWL'ING AND DX'ING

The broadcast station addresses in 'Shortwave Listening and DXing' article in June issue are all outdated, except those of GDR, France, Canada and USSR. Besides, due to budget restrictions, some countries are issuing seasonal QSLs only.

Those interested in enhancing interest in SWLing (shortwave listening) can write to the 'Indian DX Club International' (IDXCI), whose monthly bulletin, Asian DX Review, carries some useful tips. Please enclose reply paid, self-addressed envelopes while writing to IDXCI, G.P.O. Box 646, Calcutta 700001. For a sample copy of their bulletin, send them postage stamps worth Rs 3 with your request.

DWARKANATH S R
Bombay

■ Mr Rao has stated in June issue that Air Traffic control, Bombay is heard on 10.018 MHz and ATC, Madras on 10.066 MHz. In my experience, however, I have noticed that HF channels used by ATC are allotted to a number of ground stations and not to just one. VHF channels are allotted to each station for individual use.

I have been monitoring some of these frequencies for the past two years, occasionally. I stumbled on to them quite accidentally, and one led to the other. The following are the frequencies actually heard by me, along with the stations I have heard:

6624 kHz: Karachi, Lahore, Bombay, Delhi, Bahrain, Tehran, Kabul etc.

3446 kHz: Same stations as above. In addition to these, the same stations also use 13336 kHz, though I have never been able to receive it.

Another set comprises 8882 and 5673 kHz Bombay, Madras, Calcutta, Rangoon, Columbo, Kualalumpur, etc.

A domestic frequency for Indian stations only is 8938 kHz, used by Delhi, Lucknow, Varanasi, Patna, Ranchi, Nagpur, Calcutta, Bombay etc.

In addition to these, I have also heard mention at 10009, 8847, 5547, 6975, and 8889 kHz, though I have never monitored these.

6624 kHz seems to have changed to SSB now, since the messages are garbled, but 8938 is operating perfectly and can be monitored on any ordinary SW receiver with the necessary bands

With regard to the standard time signal, apart from 15 MHz, these signals can also be heard on 5, 10 and 20 MHz National Physical Laboratory gives the Atomic Time Alarm (ATA) continuously on 10 MHz along with announcements of time (in IST, not GMT) every 15 minutes and not every half hour as Mr Rao has specified The announcement can be heard during daylight hours.

JAYANT SHAH
Lucknow Cantt

The author, Mr L. Jagadhiswar Rao, replies:

Mr Dwarkanath may please note that the addresses given in the article are those of the embassies and not of the broadcasting stations. One can write to these embassies for the exact addresses of broadcast stations and the services rendered by them. However, I agree that some of the countries have either stopped giving QSLs or are giving seasonal QSLs only due to overhead charges/operational difficulties/ government policies etc.

ATC Bombay and Madras frequencies were given in the article as a small hint to the newcomer to straightaway tune his receiver to these frequencies and have the first SWLing experience All the ATCs have separate HF and VHF frequencies alloted. All major and international airports have more than one HF channel for case in operation in case of bad propagation conditions. Some ATCs also use repeaters/inverters. But no two ATCs will operate on the same frequency. So, what Mr Shah has heard on 6684 kHz or other frequencies is not a single aircraft conversing with a group of base stations, but the aircrafts, bound to different destinations, flying over and around a particular base station reporting or taking advise/clearance/ weather forecast etc. It is a simple logic that if a particular frequency is used by more than one base station then the whole air traffic will be in shambles.

Mr Shah is right in pointing out the details of National Physical Laboratories giving ATA. An additional information on this is given below·

SOME TIME AND FREQUENCY STATIONS

Call Sign	Frequency (kHz)	Location
WWV	2500; 5000, 10000, 15000	Ft Collins, Co, USA
WWVH	Same as WWV	Kekaha, Kaual, HI
CHU	3330; 7335; 14670	Ottawa, ON, Canada
RID	5004; 10004; 15004	Irkutsk, USSR
RWM	4996; 9996; 14996	Novosibirsk USSR
ZUO	2500; 5000	Pretoria, S. Africa
VNG	7500	Lyndhurst, Australia
BPV	5000; 10000; 15000	Shanghai, China
JJY	2500; 5000; 10000, 15000	Tokyo, Japan
LOL	5000; 10000; 15000	Buenos Aires, Argentina

At 18 minutes after every hour, National Bureau of Standards station, WWV, gives bulletins on solar activity and the condition of the earth's magnetic field. WWV is on the air continuously, using constant power levels and omni-directional antennae. Information on all WWV services is available from the National Bureau of Standards, Boulder, Co 80302, USA.

IC TRANSMITTER

Regarding IC transmitter circuit in May 1984 issue, I want to know (a) whether an AF input from a record player or tape recorder can be directly fed into pins 5 and 1 of the IC, and (b) if you could suggest some equipments for the 3028A IC, as it is not available in Calcutta.

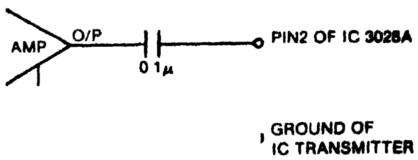
SASWATO R. DAS
Calcutta

■ As 365pF gang condenser is not available in the market, can I use any other gang in its place?

SUBHASH JAIN
Calcutta

The author, Mr N.T. Keshava Kumar, replies:

The AF output of any tape recorder, record player, or even an amplifier, can be connected through a 0.1µF series blocking capacitor connected to pin 2 of the IC, the other lead being connected to the ground of the IC transmitter. The volume control should be adjusted for optimum performance.



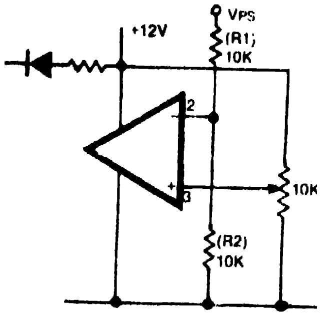
THE AMPLIFIER MAY BE THAT OF A TAPE RECORDER, RECORD PLAYER ETC.

LM3028 or CA3053 IC may be used as a near equivalent of CA3028A

As regards gang condenser, one can use any of the commercially available types used in transistor radios, such as PVC 2J, PVC 2X etc. Only one pair, i.e. the central and either of the two end terminals, should be used.

OVER-CURRENT PROTECTION

With regard to my circuit idea in July issue, I request EFY readers to disregard the last line in the write-up since I have realised that for higher voltages it is not absolutely necessary to increase the voltage of the auxiliary supply. Instead of that, one can use the following modification in the circuit up to Vps = 24V.



For higher values of Vps, R1 and R2 have to be adjusted such that voltage at pin 2 of the IC is not more than 12V

Another thing to note is that the resistor Rsc may be included only for extremely regulated power supplies, i.e those power supplies whose internal resistance is less than 0.1-ohm. For those power supplies whose internal resistance is about 1-ohm or more, Rsc need not be included. Their natural voltage drop with increasing load suffices our purpose.

S.G KUNTE
Pune

MIND READER

This has reference to several letters received in which it has been pointed out that the last number in card 'C' in my article in EFY June issue should have been 2 and not 20. I am thankful to the readers for having pointed out the mistake.

The error crept in while preparing the final drawings. Since card 'C' contains all numbers having a binary equivalent of 'XXX1X', 20 cannot appear on this card as its binary equivalent is '10100', where the second-last digit is 0 instead of 1.

ASHOK BAJAJ
Lucknow

FLOPPY DRIVES

The report on floppy disc drives in July issue is very interesting and easily understandable, even by a layman, which we appreciate very much.

However, I would like to bring to your notice that among the names of manufacturers etc indicated in the report by the author our name is not included, even though we are the leading manufacturers/exporters of floppies in the country.

We are a unit manufacturing floppy disc drives of all types since August 1983. We manufacture floppy disc drives in technical collaboration with Shugart Corporation, USA, the world leaders in floppies, strictly as per standards specified by them.

Model SDP 801 (20cm) floppies are already in use in the country and leading manufacturers like DCM, Wipro, CMC, PSI, HCL and Uptron are already using our products. Very recently we have developed the new model SDP 860 and also SDP 400 and 460 which are mini floppies. The SDP 860 is a new product and the same is already in use with the manufacturers of repute referred to you above.

We are also proud to inform you that drive SDP 860 is being exported to Sweden, Germany, Italy, Hongkong, Australia, Switzerland, Denmark, USA, and the UK. We have already exported nearly 650 drives during the last three months and we are hopeful of exporting a minimum of 2000 before the year end.

Our microfloppies are also on the design board, and we hope to introduce the same in the Indian market before this year end.

I am sure you will appreciate and also join us in sharing our pride of exporting quality products of our industry which is in its infant stage in our country.

T.S. SUBRAMANIAN
Secunderabad

■ I have noticed two mistakes in my article on 'A Report. Floppy Drives' in July issue.

Please read the last but one line in the first column on page 19 under the heading 'Terminology' "... into various **concentric** circles which are called 'tracks'. These", and not **eccentric** circles as printed.

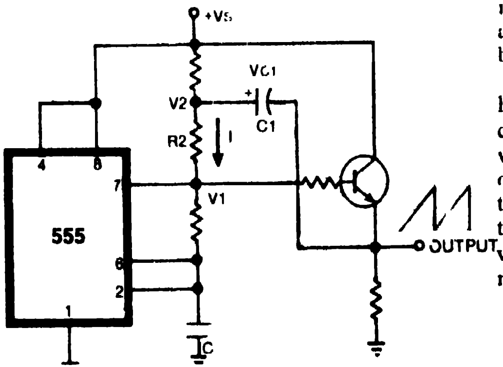
There is a printing mistake on page 22, column 1, line 6. Please read this line as "But in this case the **Job** of reading data from the"

RAVI KANT TAXALI
New Delhi

SAWTOOTH GENERATORS

The article on sawtooth generators in EFY's April issue was quite interesting. I would like to add a few points.

There is an alternative method of generating the sawtooth waveform by using a bootstrap circuit, with a 555 IC, as shown here in Fig. 1.



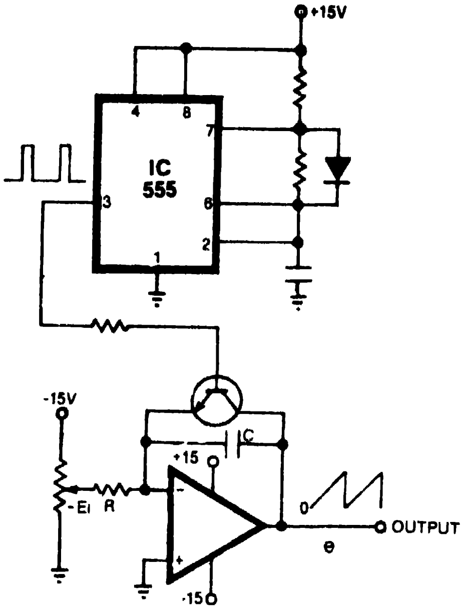
$$I(t) = \frac{V2 - V1}{R2} = V_{C1}(t) - V_{BE}(t)$$

The advantage of this circuit over the one published is that the sawtooth output is automatically buffered.

A versatile method of generating sawtooth waveforms is shown in Fig. 2. It consists of an op-amp integrator whose capacitor is intermittantly reset by a narrow pulse train from, say, a 555 IC based pulse generator. The ramp output equation with time 't' is

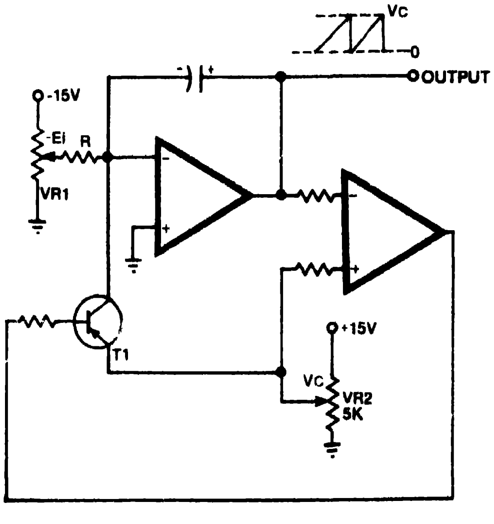
$$e_o = -\frac{E_i}{RC}.t$$

Note that the sawtooth frequency is decided by the interval of the 555 IC pulse train, while the ramp amplitude is decided by either input DC voltage E_i, or input resistor R, or the feedback capacitor C. Thus we can have a voltage controlled sawtooth amplitude through variations of E_i or manually adjusted amplitude through a variable R or a potentiometer providing E_i.



Obviously, the pulse generator and integrator can be combined together simply by comparing the integrator output with a fixed voltage in a comparator with hysteresis. When the sawtooth output rises above the comparison voltage plus hysteresis width, the comparator output switches the discharging transistor on. The capacitor is rapidly discharged until the voltage comes below the comparison voltage minus hysteresis width. The cycle continues and the comparison voltage and hysteresis can be chosen to give suitable sawtooth amplitudes.

One such circuit is shown in Fig 3. Here, however a direct hysteresis is not used. The comparison voltage V_c itself is brought to zero when the transistor is turned on, simultaneously discharging the capacitor, giving a sawtooth from zero to V_c always. The advantage of the circuit is that the frequency is controlled by voltage E_i from potentiometer VR1 (or externally) and the amplitude is controlled by voltage



tage V_c from the potentiometer VR2.

One major advantage of the op-amp sawtooth generators is that resistors can be switched for various ranges, rather than capacitors, which give better control since resistors of each range can be carefully selected. For example, various fixed values of R can be selected for various ranges and potentiometer VR1 can be varied for various frequencies in each range for the circuit of Fig. 3.

S.K. BISWAS
Bangalore

The author, Mr A.K. Narayanan, replies:

Mr Biswas's circuits were a pleasure to go through. The bootstrap circuit (Fig. 1) will be useful where waveform linearity is not the greatest concern. This circuit is, in fact, a first step towards achieving constant-current charging of the capacitor. Intuitively, one can grasp the attempt to equalise the AC voltages at both ends of R2, by feeding the AC content of voltage V1 back through the emitter follower and C1 This results in reducing AC currents in R2, thus providing a near-constant current into C But a brief analysis will show that C1 has to be large enough so that dV_{c1}/dt tends to be zero.

This will, mainly, place a lower limit on frequencies where satisfactory operation is possible. Nevertheless, this circuit could be the choice if only one extra transistor is to be optimally used.

In the circuit of Fig 2, notice that the 555 is not controlled by any signal or parameter derived from the output. The lack of a closed-loop control has inherent problems. For example, if the 555 pulse width is greater than a critical requirement, the output gets a flattened bottom. But remember, it is the open 'loop' nature of the circuit that gives it the feature of independent frequency adjustment.

The most interesting of all is the circuit of Fig 3 The ramp-up is easy to understand when T1 is off. The discharge of the capacitor occurs when T1 is on, at a rate equal to dV_o/dt, which is approximately equal to $(V_C/R_C) - |E_i|/R$, where R_c is the potentiometer equivalent resistance looking out from the emitter of T1 Our requirement is rapid discharge, i.e we have to maximise V_c/R_c It can be seen that if the comparator doesn't switch fast enough to turn off T1 on time the output may even go to $-V_{cc}$, since the discharge rate is high (By the way this circuit can be modified, by including a series resistor to control the discharge current, to make a good triangular wave generator.)

A certain problem while building op-amp circuits is slew rate This keeps op-amp based circuits to a few kHz range if reasonably good specifications are placed on the waveform.

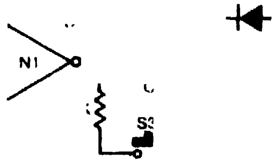
Thank you, Mr Biswas, and hope the readers found the discussions useful.

ELECTRONIC DICE

First accept my congratulations for the useful, exciting and easy-to-build circuit of 'Electronics Dice' in EFY's June issue But no V_{dd} and V_{ss} connections were shown in the circuit for oscillator IC CD4049

One diode 1N4148 can be connected in series with power supply to protect the IC from reversed connection of power supply.

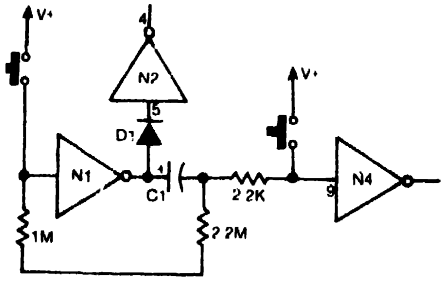
The display goes off after approximately five seconds. If someone wants to see the LED glowing again, he may use one more push-to-on switch with a 10k resister in series, as indicated below The same LED will glow on pressing S3 for a fraction of a second only.



RAVINDRA KUMAR
Lucknow

The author, Mr R. Shankar, replies:

Mr Ravindra Kumar's suggestions are feasible. However, in my circuit D2 is not needed at all. This is because the CMOS IC contains two diodes in itself The connected portion is redrawn below.



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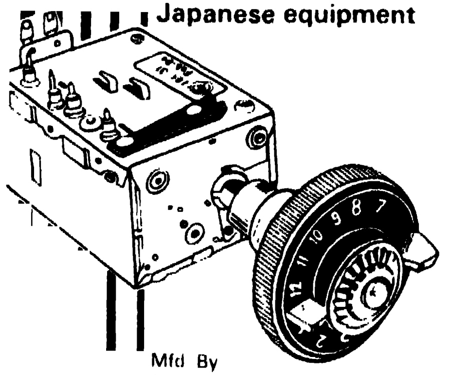

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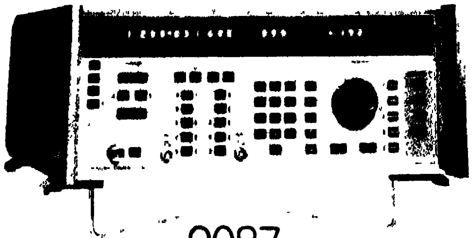

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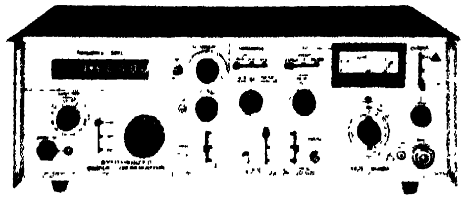

9082

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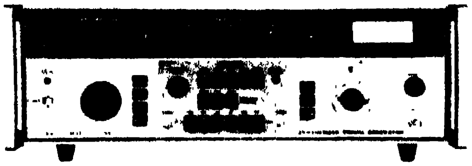
- AM, FM, ØM, Pulse Modulation
- - 130dBm to + 19dBm
- 3 x 10^{-10} per day stability
- Passive doubler to 1040MHz



9084

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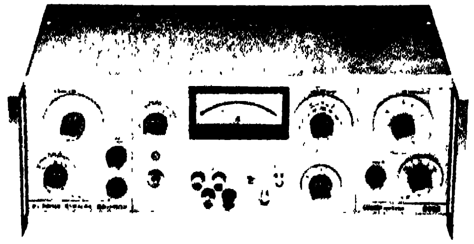
- High Spectral purity



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IN INDIA ....

DoE centre for Madras

The foundation stone for the building for the Department of Electronics (DoE) was recently laid at Adyar, Madras. The building is expected to be ready in 12 to 18 months' time.

The DoE will locate centres for electromagnetic interference/electromagnetic compatibility and reliability engineering studies. These centres will provide a focal point for research and development in these fields. There will be considerable interaction between these centres and other institutions in and around Madras. Thus, several industries and R&D units would benefit through the facilities and expertise available at these centres.

It is planned to install an earth station at the top of the DoE building so that it can interact with INSAT 1B. Thus, whatever information is stored in the Informatic Centre at Delhi can be retrieved in Madras through the satellite and the earth station.

Industrial robot developed

A computer-controlled robot with tremendous scope for industrial application has been developed at the Indian Institute of Science, Bangalore. Except for the computer, all material used is indigenous.

Developed by two researchers, S.K. Sharma and V.K. Tiwari, the robot, weighing only 55 kg, functions like the arm of a man. It can lift and place any item within the workspace area, covering a total of 2600 sq. cm. It has four joints operated by stepper motors, which are capable of moving the arm with a high degree of precision.

A microcomputer based on Intel 8085A microprocessor controls the joints and the gripper of the robot. It can process sensory signals and issue instructions to various motors for the required movement.

The robot can perform a variety of tasks at different speeds. It can be operated either from front panel or from a video terminal. Though the robot has a tremendous potential, it has scope for further improvements before it becomes a commercially viable proposition.

No private import of CTV tubes

The government does not propose to permit individual colour TV manufacturers to import colour picture tubes.

This is as a result of DoE's decision to channelise all imports through Electronics Trade and Technology Development Corporation (ET&T). An order for 800,000 CTV picture tubes has already been placed by ET&T, the bulk purchase getting competitive rates and saving foreign exchange.

Even as these plans got underway there was a demand from the manufacturers for immediate supply of picture tubes. Thus, it was decided to airlift 50,000 picture tubes at an extra cost of Rs 240 per tube. It is proposed to absorb this additional cost between the industry and the channelising agent ET&T and not to pass it on to the consumer.

Curb on TV test instrument imports likely

The government is seriously considering a proposal to impose restrictions on the import of test and measuring instruments which are required by broadcasting and receiving segments of television network. This is expected to give a major boost to the indigenous production of these instruments.

It is hoped that these revisions in the import policy by DoE will enable Indian manufacturers to capture the demand of the expanding TV network. The requirement of these instruments is likely to grow substantially with the massive expansion of TV coverage by the end of this year and the resultant growth in production of TV sets.

At least 35 such test and measuring systems are used in the TV network as well as in the manufacture of other consumer electronic products. This entire requirement is expected to be met through indigenous production by 1990.

Production of phosphorus for TV picture tubes

The National Physical Laboratory (NPL), New Delhi has developed a process for production of phosphorus luminescent material for black-and-white TV picture tubes. The pilot plant has been set up at NPL with financial assistance from the National Research and Development Corporation (NRDC) with a capacity of 800 kg per annum.

The material has been tried out at Teletube Electronics Limited, Ghaziabad and Bharat Electronics Limited, Bangalore, and has been found to meet most of the important specifications. The process knowhow has been passed on to NRDC for commercial exploitation.

Companies such as BEL, Bangalore; Teletube Electronics, Ghaziabad; UR Electronics Ltd, Bangalore and Searloe Ltd, Calcutta have shown interest in acquiring the knowhow for commercial production.

INSAT 1C to be launched in 1986

The INSAT 1C spacecraft is scheduled to be launched by the US space shuttle in June 1986.

According to the minister for Science and Technology, Mr Shivraj Patil, work on the spacecraft is progressing satisfactorily at the Ford Aerospace and Communication Corporation, USA. It is expected to be ready for launching by January 31, 1986 as per schedule.

Debate on CTV prices continues

In spite of repeated assertions by the government that 48cm colour TV will be made available within a price range of Rs 5000 to 5500, not a single set has yet been sold in the country at that price.

Though a few manufacturers had announced sets with prices around Rs 5500, enquiries reveal that they have neither accepted substantial bookings on this basis, nor are they prepared to give any specific delivery date. Fall in prices could be brought about through the substantial reduction in duties on components granted by the government, but it does not seem so in the near future since all large manufacturers have inventories on which higher duties have already been paid.

Another aspect of this problem is that the DoE has restricted the import of CTV picture tubes only through the Electronics Trade and Technology Development Corporation (ET&T). While the government feels that bulk purchase of picture tubes will help to reduce CTV prices, ITMA (Indian TV Manufacturers' Association) wants that the manufacturers be allowed to import them freely.

In this connection, the government has set up a review committee under the chairmanship of the secretary, DoE, to review and monitor the progress of manufacture of CTV sets

Seminar on computer and industry

A two-day seminar on computer and industry will be held on November 10 and 11 at Allahabad under the joint auspices of the Allahabad chapter, sub-centres of The Institution of Electronics & Telecom Engineers, Computer Society of India and The Institution of Engineers (India).

With the recent explosion in the availability of micro, mini and mainframe computer systems, applications of computer in industry have also increased. The applications in industry range from manufacturing to design and development of industrial products. The commercial data processing applications also have a large share of computer time utilised by the industry.

The seminar proposes to cover topics relating to computer and industry, such as computer aided manufacturing, design, training and education; data processing application in industry; on-line process control; computer graphics; state-of-the-art in computer; microcomputers in industry and informatics.

For further details contact the convenor, Organising Committee, Seminar on Computer and Industry, The Institute of Engineers (India), Sub-centre Building, Teliarganj, Allahabad 211004.

Conference on computers, systems and signal processing

An international conference on computers systems and signal processing is to be held in Bangalore from 10th to 12th December. The conference is being held to commemorate the centenary of the IEEE and the platinum jubilee of the Indian Institute of Science.

Original papers on a very wide range of topics are expected to be presented at the conference. The topics included are: VLSI design and applications, expert systems, computer networks, modelling and simulation, large scale systems, multivariable adaptive control, medical imaging, estimation and identification, graph theoretic applications, sonar signal processing, spectral analysis, image processing, power electronics, etc.

Short courses on several related subjects have also been organised. For further details contact Dr I G. Sarma, Gen. Chairman, Indian Institute of Science, Bangalore 560012.

AND ABROAD ....

Taiwan computer companies turning to automatic testing equipment

Taiwan computer manufacturers are seeking to upgrade product quality and their companies' reputations through the use of imported automatic testing equipment for better quality control.

Multitech Industrial Corporation, a Taiwan manufacturer of microcomputers, has invested US$ 320,000 in the purchase of state-of-the-art automatic testing equipment from GenRad, USA, and began to implement the new system in its Hsinchu Science Park plant in April. Multitech engineers are now writing the highly specialised software programme necessary to guide the GenRad equipment through its testing routine.

The 2275 Board Test Workstation measures the performance of individual components on a PCB and determines if any components are defective. Conventional testing techniques could only determine if an entire board was faulty, and if found defective, it was sent to a repair station where the entire board was examined by a technician.

With the GenRad testing equipment the product quality is so improved that each individual component on a PCB works properly before leaving the factory. Costs are also reduced because the testing process is accelerated, leading to fewer production bottlenecks and more efficient handling of materials.

Multitech was so satisfied that it installed another unit in July at its Taoyuan plant, which produces IBM PC compatible personal computers for a large US telecommunications concern.

World's largest SPC communications system

An EMS 12000 communications system, with 16,000 extensions—making it the largest stored-programme-control PABX in the world—has been put into operation by Siemens at its offices in Munich. It replaces the old telephone system which had grown steadily over the last 30 years and could no longer meet today's or tomorrow's communication demands.

The phoning rate has risen to 65,000 outside calls and 140,000 inside calls per day. But communications have not only increased in volume, they have also become more diverse. Transmission of texts, for example, has grown in impor-

The GenRad 2275 Boad Test Workstation at Multitech's Hsinchu, Taiwan Plant

Robots Help in Making Refrigerators

Every twenty second a refrigerator comes off the production line of the Soviet refrigerator plant at the Siberian city of Krasnoyarsk, manufacturing the 'Biryusa' refrigerators internationally known under the brand-name of 'Snow-cap'. In view of such fast rates, the loading of the refrigerators of seven modifications for 730,000 households a year was quite a problem. But now the plant experts have developed a unique manipulator, using which two young women can load 27 refrigerators into a universal container within a few minutes. The manipulator has been recognised as an invention and a patent has been given to its designers.

The plant itself has its own design office, an experimental section and finally a shop manufacturing robot. Two robots have recently been taught to make fitter-drivers, which has raised labour productivity by 100 per cent. There is a robot, which fastens the refrigerator to the wooden bottom before packing. Automatic operations with electron memories are used in the painting and galvanic treatment sections and also for stamping and welding of its parts. Several production sections are now being roboticised at a time. By the end of 1985 the roboticisation of the plant will release many workers who will be retrained for more skilled jobs.

The wide programme of technical retooling and automation being carried out in the Soviet industry has already brought a marked rise in all-round productivity.

—Boris Ivanov

tance alongside voice communication.

The main advantage for the user of the new system is that voice communication is optimised by the many features that only an SPC system can offer. Many of the everyday problems that occur, when telephoning, can be solved at the touch of a button by the automatic callback facility for internal calls or the last-number-redial feature for outside calls. The system also provides for call forwarding, three-way or six-way teleconferencing and access to the central call number memory.

SPC engineering is also helpful to the system organiser and technician. Allocation of features, classes of service and call numbers can be handled flexibly without the need for hardware modification. The modular system design also allows further components to be added easily for electronic office communications. The EMS system, with its task-oriented workstations and system units, will in this way become the center of fast and reliable voice, text, image and data transmission and document handling.

Portable wordprocessor from UK

A portable wordprocessor, the size of a paperback book, called Microwriter, has been developed by a British company, The Microwriter Limited. Budding writers and jet-set executives can now use microwriting, even when on the move.

The Microwriter comprises a 5-finger keyboard, a control key and an LCD display with an 8k memory (approximately five A-4 pages) and communications capacity. Its rechargeable batteries provide 30-hour use between charges.

The keyboard of the Microwriter is operated with one hand—each finger engaging one key. The full alphabet, numerics, punctuation and all editing commands are keyed in by simply depressing various combinations of the keys. All text is automatically stored on the memory as it is written. According to the manufacturers, the basics of 'microwriting' can be learned in an hour.

The Microwriter has facilities to compose, edit, correct and format. It can be plugged on to a printer, typewriter, computer, cassettes or electronic telex through the RS232 interface for various uses. Microwritten texts can be transferred to ordinary minicassettes or floppy discs on a microcomputer for storage.

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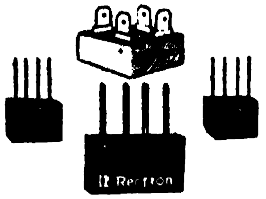

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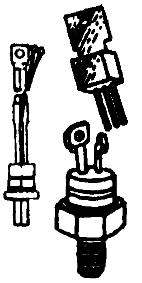

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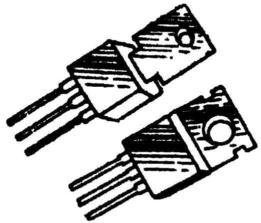

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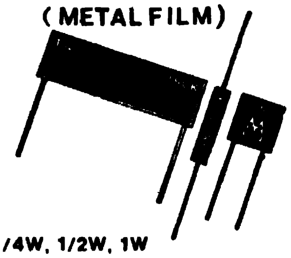

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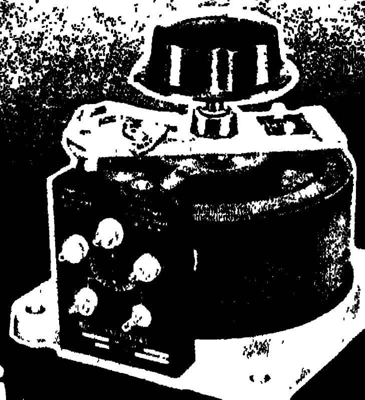

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Digital Electronic Developments Leading to INTEGRATED AUTOMATION CONCEPT

Jayanta Chatterjee

New technology input like bit slice processors, 16-bit microprocessors and improved versions of 8-bit microprocessors as well as other advanced digital electronic techniques have been increasingly used over the last decade for instrumentation, sequential motor control through PLC, display and recording or logging of data etc. With introduction of new technology, while the cost of the basic building blocks are coming down, the cost of interfacing among the above elements becomes complex and costly. The technology and market trend therefore has forced leading international manufacturers to look for an integrated solution for process/machine automation.

Definition of ICAM

We have defined such an integrated solution as ICAM, which can be explained as 'integrated control automation monitoring' system. Explanation of this acronym for discrete part manufacturing industries is also prevalent as 'integrated computer aided manufacturing'.

We define ICAM as a series of freely configurable multitask subsystems compatible with each other for direct intercommunication through advanced digital electronic technique, physically located throughout a manufacturing facility and functionally assigned to all types of control, acquisition, measurement and monitoring tasks for productive automation and energy economy.

Allen-Bradley still uses 'PLC' as a prefix to the module numbers of a range of such hardware because the word 'PLC' is their registered trademark in USA since they originally coined this acronym. But as a concept, stand-alone PLC is on the way out compared to the integrated concept based on distributed digital control.

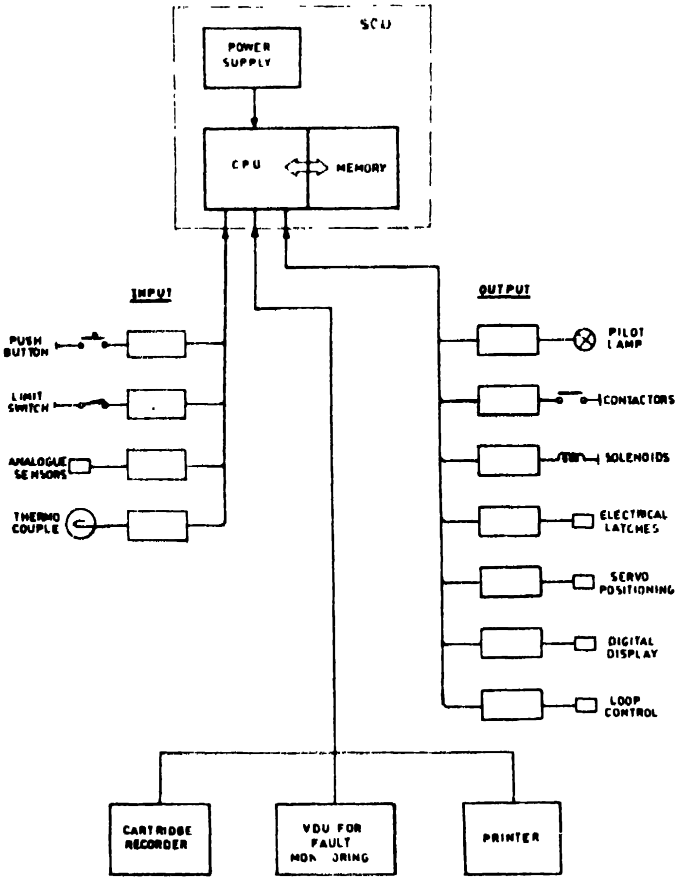
Advantages of digital control

This terminology today indicates an electronic system which is capable of inputting data, providing high speed calculations and decisions upon the data and then outputting the results to various levels of plant operation and supervision.

Process control engineers have been using computers as well as discrete electronic hardware and control relays. Programmable logic controllers started bridging the gap between these two areas and in the ICAM system as explained above, the various disciplines are merging together to form a unified concept.

Cost of such development

As the electronic circuits are becoming more and more integrated, they are effectively becoming cheaper. If the cost



Schematic diagram of basic control/monitoring.

of a unified family of intelligent hardware is projected into the future in comparison to the cost of software, engineering etc, the hardware is increasingly becoming inexpensive. Very flexible and intelligent software can be accommodated on single boards due to improved memory capability. ICAM hardware can, therefore, contain built-in software also known as 'firmware', which is capable of very straightforward man-machine interface even at the lowest level

This automation concept saves costs in areas like standardisation of circuitry, easier maintenance, reduction of interconnection and reduction of electromechanical elements.

Even in the recent past, while using PLC, the operator facilities were usually provided in the form of large electromechanical mimic panels and equally large control desks containing hundreds of pushbuttons and lamps and even annunciation windows. Now, with the ICAM concept, a higher level of plant information and control facilities can be provided at a lower cost with the added advantage that changes can be made without new mechanical or civil construction.

In the ICAM concept, rows of control room pushbuttons are replaced by dust-proof, rugged, sealed membrane keypads and flashing lamps, mimics, annunciation windows are replaced by dynamic colourgraphic or bicolour displays and printers or LCD displays and voice alarms.

US standard specification of all such systems calls for direct shopfloor installation conditions. All parts of ICAM system are therefore physically robust and tolerant of harsh operating conditions like 50°C ambient. Most field parts are designed for 60°C ambient and 95 per cent humidity rating.

Flexibility

This is an important advantage of programmable automation in case of consultants, plant builders and OEMs. The pressures of designing a large industrial plant are somewhat relieved if the control aspects can be flexible for a large proportion of the specification and commissioning time phases. If the interconnection of the various control elements, i.e. the operation logic, is specified in programme

ICAM Application Areas in India

The scope of applying integrated automation concept is vast in India. As the competition in market place increases and operational efficiency becomes more and more an important national issue, the need for productive automation will grow. A phenomenon which has already been witnessed by USA, Europe and Japan, is now taking shape in India. The following is not an exhaustive, but just an indicative list of applications where ICAM is gaining popularity:

MANUFACTURING/ TRANSPORTATION/ MACHINE TOOLS
Transfer/index machines
Assembly machines/robots
Test stands
Grinding machines
Drilling
Material conveyors
Stacker cranes
Accummulating conveyors
Sortation conveyors
Heat treatment/plating/welding
Integrated manufacturing
Painting
Injection and blow moulding
Metal forming

CHEMICAL/ PETROCHEMICAL:
Batch process /product handling
Weighing
Blending
Packaging
Water/waste treatment
Material handling (solid/fluid)
Refinery/drilling/pipeline

FOOD/PHARMACEUTICAL/ BEVERAGES
Process
Brewing
Distilling
Packaging
Bottling/canning
Weighing
Blending

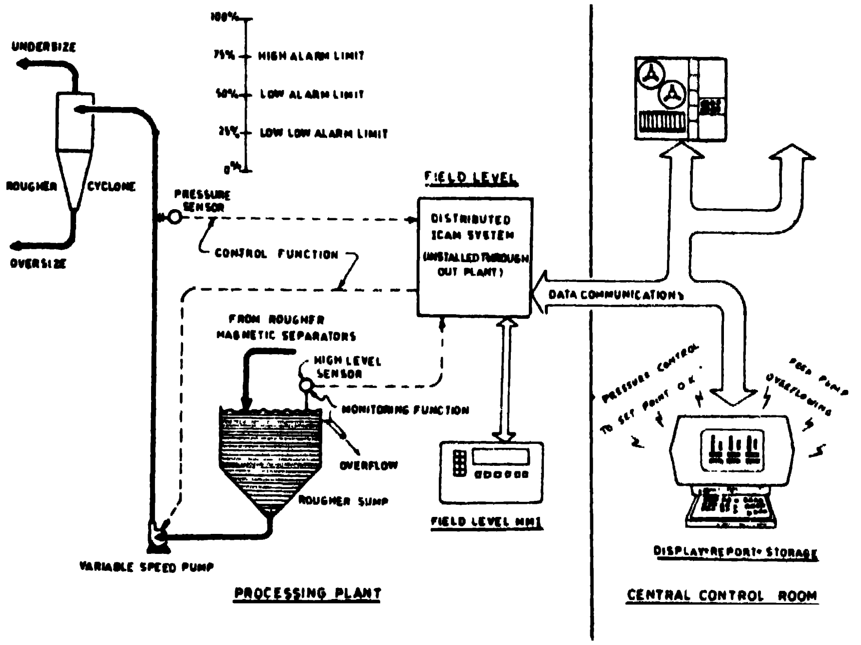
MINING & METALS
Metal mining
Coal handling/coal washery
Ore handling/beneficiation
Cement/sponge iron
Continuous casting/rolling mills
Cranes/stacker and reclaimers
Electrolysis (copper, aluminium)
Environmental control

POWER & UTILITIES
Sequence and loop control
Auxiliary plant control (coal handling, water treatment etc.)
Distribution network control

PULP/PAPER/LUMBER
Batch digestor
Chip handling
Coating/paper machine
Wrapping/stamping
Winding/processing

GLASS/FILM
Process control
Forming
Finishing
Packaging
Palletising

GENERAL
Energy and load management
Process optimisation
Remote supervision/control
Local area and data network
Visual intelligent control



Distributed ICAM concept showing close loop and open loop control.

rather than actual hard connection, then this allows the control system manufacturer to be far more relaxed and tolerant to change.

ICAM systems permit change of control data acquisition or monitoring formats even at the commissioning stage and beyond. Most systems permit on-line change at the post-commissioning stage. Various close loop and open loop controls become only software routines and therefore amenable for change. Field hardware are built for standard real-world signal levels like 110-240V AC, 24V DC or 4-20mA. In many cases, the same hardware can be made suitable for another signal level just by operating a few miniature switches built into the card.

Reliability

Most critical components for ICAM hardware fall in the large scale integrated (LSI) or very large scale integrated (VLSI) category. The number of connections between components therefore become increasingly smaller. As we all know, a modern microprocessor chip contains an equivalent of many thousands of individual transistors and other components which even ten years back needed complex interconnection by hand. In comparison with its complexity, the ICAM hardware is more reliable than its predecessors like PLC with hardware processor or stand-alone instruments.

Reliability does not end with the low rate of failure of a particular component or a module. MTTR, i.e. mean time to repair, is of equal importance today. Most ICAM hardware process intelligence and can therefore provide self-diagnosis even at the field level. The resident software helps to pin point faulty parts quickly and in many cases the faulty part of the hardware gets automatically bypassed and a standby system takes over for critical operation.

The ease of operation

The standard elements like lamps, pushbuttons and relays built into conventional control desks often give a deceptive appearance of simplicity. One does not see at first sight the consequential losses due to failure of lamps, pushbuttons and the aggregate cost of relay failures. How long can a control desk get? What are the human limits of maintaining an interaction with such increasing multitude of arrays? These questions remain unanswered.

Large desks at a process plant are often maintained at great cost and at a larger risk of fatigue inefficiency, but by apparently inexpensive personnel. Desks are often manned by two or more operators who are changed or relieved periodically. Thus total requirement of personnel increases, the training cycle is often long and the plant becomes susceptible to the cost or operator turnover.

Once the industries switched to the ICAM concept, it soon became apparent that plant sizes could become much larger with the same central control facility and operators could acquire better appreciation far more quickly because of the audiovisual guidance available.

The use of standard graphical symbols, alarm printing techniques, video guidance to the operator, use of colour codes on VDU for easy diagnosis of status and parameters—all made the operator's life much more interesting and provided better management contról on plant operation.

No 'eggs in one basket'

Mineràl processing, material handling or large petrochemical plants lend themselves very well to the distributed control concept of ICAM. These plants are spread over many kilometres and although control, or atleast monitoring, is required in a central position or positions, the devices to be actuated or read are distributed widely. There are many kilometres of conveyors, various batching, storage, packaging and routing actions and although the plant has an integrity, most major sections can be operated separately. There are very often standby or alternative streams of equipment.

As an ideal solution to this situation, the ICAM concept proposes distributed control with individual station level intelligence independently controlling various sections. They are then linked together in a token passing network also known as floating master data highway; station control units are grouped under area control units. The serial links take the form of twisted pairs of cable transmitting and receiving communications between stations at high speed and with great accuracy. Breakage of link anywhere in the system can easily be identified by other stations.

The master-slave format of a central computer-based digital control or conventional hierarchial controls is superceded by a token passing 'floating master' data highway. Not all eggs are in one basket.

Savings in cabling

Control cables in our country will always become more and more expensive because of the status of copper as well as oil-derivative resources. This is one factor which is making distributed digital control increasingly economical. In such a system, the cable runs up to the local station control, which will be a short distance away. Between controllers, only a single twisted pair of a serial link is used. Even in the central control room, the use of colour graphics or intelligent operator interfaces save a large amount of interconnection between instruments, digital I/O racks and mimics/control desks as compared to a conventional PLC system.

Modular plant design

This is another important aspect which is making distributed digital control the workhorse of the industry. The costs in time and money of specifying every new plant from feasibility status to civil design, process design and control design to issuing enquiries and evaluating various types of bids, contract awarding and then erecting and commissioning every time a new plant for the same purpose, are becoming extremely expensive.

User industries and engineering consultants the world-over, are now trying to modularise plant design. This is a way to rationalise the above costs by designing an optimum minimum size plant once, which would be costed and will be ready for implementation over a short stretch of time. Larger plants are constituted by combining a number of such 'modules'.

Distributed digital control concept of ICAM applies itself neatly to this principle. The democratic data highway which can be extended up to 64 stations makes it possible to link the control system of each plant module to provide an overall integrity.

New developments like microprocessors have been increasingly used in equipment like PLC, DAS, instruments, loop controllers and the cost of such building blocks using electronics have become increasingly economical. However, due to diversity of hardware and software approaches, the cost of interfacing and transfer of information among the above building blocks have become complex and costly.

The need of the moment is therefore a unified family of hardware/software modules directly compatible with each other which we have called 'ICAM', to merge close loop and open loop, sequential and continuous control, data acquisition and status monitoring to achieve the following covering features of equipment groups as above:

(a) Plant data input/output with alarm detection and presentation,
(b) Process/machine operation data presentation on demand or periodically,
(c) Continuous control,
(d) Sequence control,
(e) Position control,
(f) Historical data recording,
(g) Trend recording and analysis,
(h) Process simulation,
(i) Interaction between operator and process/machine,
(j) Speed/direction control,
(k) Energy management. □

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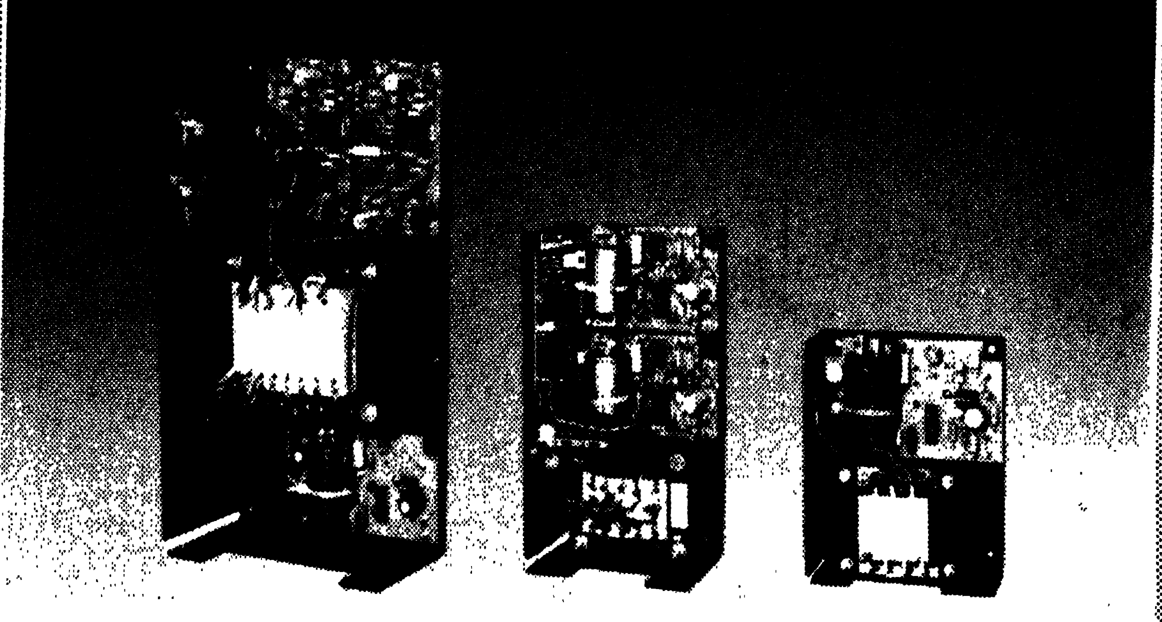

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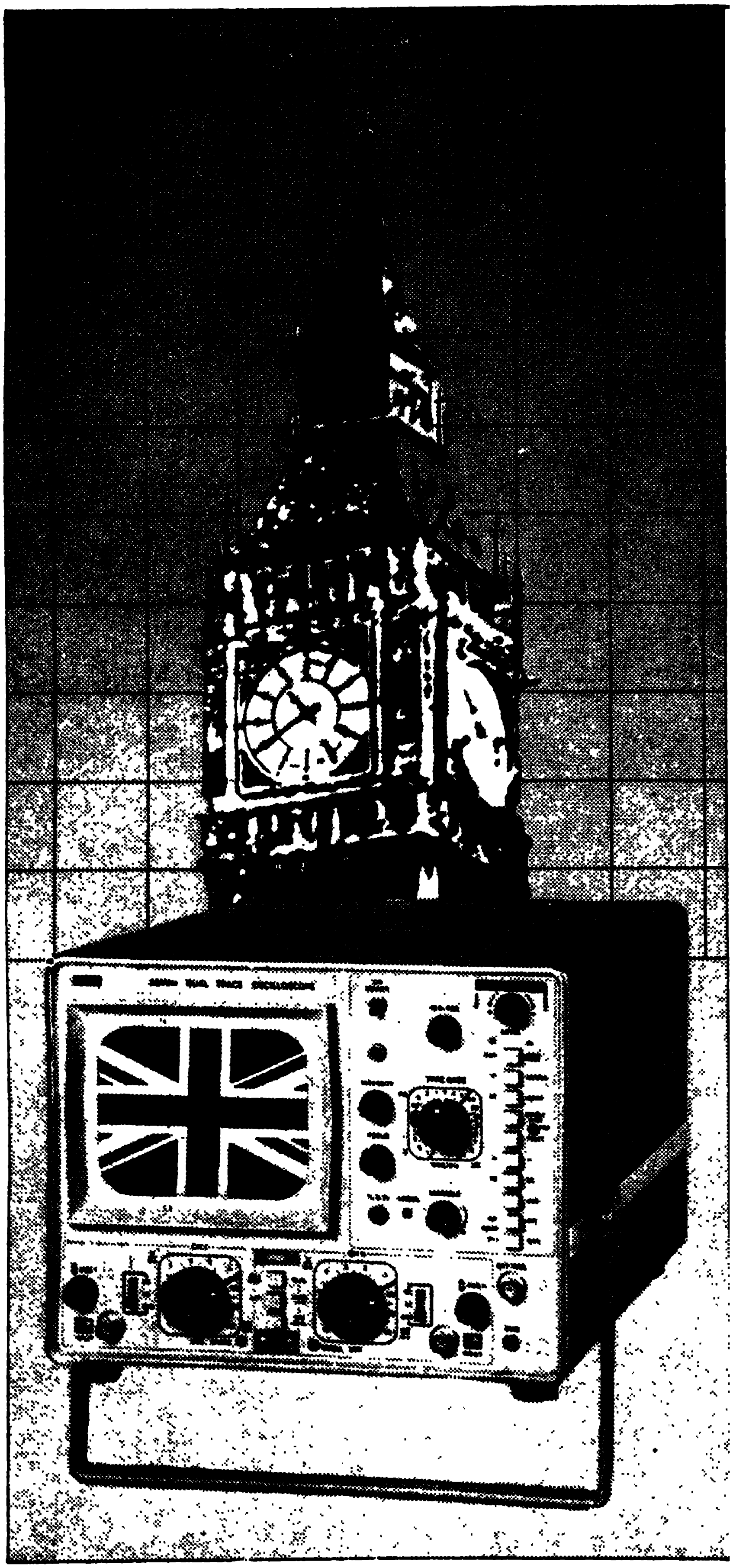

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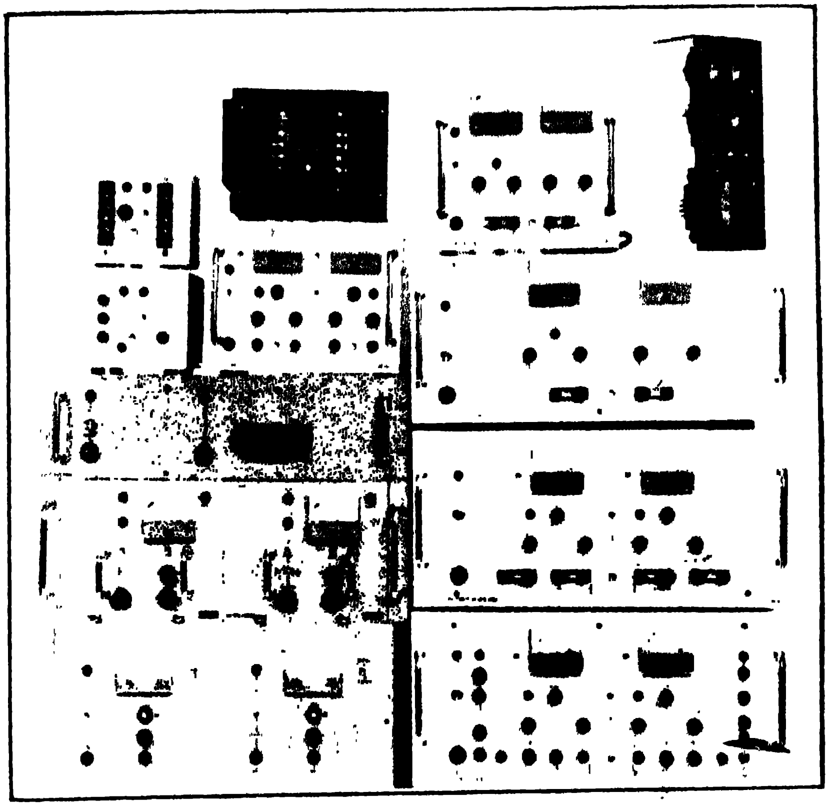

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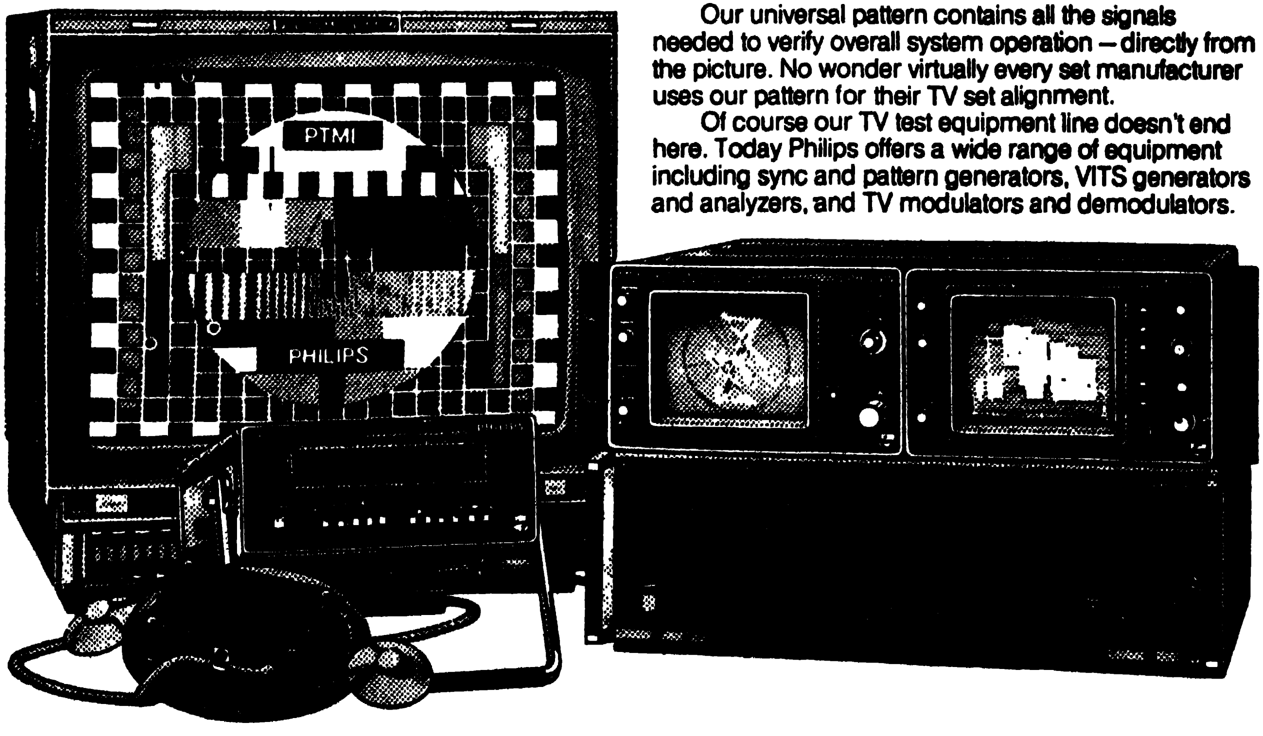

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K. Venkatesan

It is a well-known fact that the electronics industry depends very much on the solder joint. In spite of many new innovations viz welding, bonding etc, the solder joint holds its esteemed position. Further, the revolution that has taken place in the miniaturisation has necessitated a study of the soldering techniques in all its aspects. Soldering, as defined by the American Welding Society, is a forming process in which coagulation is produced by heating (below 800°F) and by using a non-ferrous filler metal that has a melting point below that of the base metals.

New, exotic, light weight, reliable and expensive components are being assembled into the highest density packaging ever achieved. These conditions made it mandatory that the soldering process be performed accurately the first time to minimise damages to materials and loss of production effort.

Hand soldering

An engineer concerned with soldering connections must consider many factors in designing a solder connection. Of prime importance are material solderability, diameter and type of solder alloy, flux type and percentage and the proper heating method. Each of these factors require special attention to ensure that once the product is sent to the assembly area, soldering will be achieved with minimum difficulty. Although many automated soldering processes have been developed and are being used, hand soldering is still one of the most practical methods. The low costs for its initial equipment and set up, and ease of training operators has made it very effective for use with new materials and packaging techniques.

Solder connection

The most important requirement for a soldered joint is that of metallic continuity between the solder and the surface which is soldered. The atoms of the solder actually form a metallic bond with the atoms of the metal being soldered.

In order to attain this unity between the solder and the metal being joined, the joint and solder must be heated to a temperature sufficient to melt the solder and raise it to soldering temperature. Further, all the surfaces to be soldered must be free of contaminants so that the solder may alloy properly with the atoms of the metal surface being soldered. The choice of a proper solderable metal, solder alloy, appropriate flux and the design of the joint so that it can be heated suitably, are the factors to be kept in mind to assure the wetting or alloying which will permit a reliable connection.

The important considerations for solder connection are: (a) solderability, (b) flux choice, (c) solder alloy choice, (d) soldering methods, (e) establishing the right time/temperature relationship and (f) soldering irons -types and construction.

If each of these are dealt with correctly, the end result will be a reliable connection, produced economically and acceptable by quality control.

Solderability

This indicates the care with which molten solder will 'wet' the surfaces of the metals being joined. Wetting is a surface phenomenon which depends, amongst other factors, primarily on surface cleanliness. When molten solder leaves a continuous, permanent flux on the metal surface, it is suppressed to wet the surface. Wetting is facilitated by fluxing and solderability depends on the activity of flux. This aspect is discussed in detail later.

In hand soldering as well as any other form of soldering for electronic applications, restrictions are often placed on the activity of flux that can be used. Therefore, it is essential to restore solderability if the flux is not sufficiently active to provide reliable solder connections. Very often, in hand soldering, it is possible to pile on solder, thus masking poor solderability conditions.

The condition of the surfaces to be soldered determines the success of the soldering operation. Adequate control must be exercised to make sure that materials retain solderability from incoming inspection through storage and into the actual soldering operation. Many solderable surfaces may be spoiled in-house by improper handling, oxidation, incorrect coatings, potting components, mould releases and various organic compounds. Surfaces must be clean and free from all contamination to achieve reliable economical soldering connections.

Soldering flux

Soldering is a solvent action that takes place between metals. This action does not take place if the metals are insulated from each other by any type of non-metallic barrier. It is the function of the soldering flux to remove any such oxide film or barrier and to keep it away during soldering operation, so that the respective metals can make metallic contact and alloy with each other.

Hence, it can be seen, that a soldering flux is something that causes the liquid solder to make contact with the metal being soldered, or in technical terms, to 'wet' the metal. It must be understood beyond any doubt that the flux does not undergo any chemical reaction whatsoever, during the soldering process. It does not constitute any part of resultant alloy also. After soldering, the flux residue and the trapped oxides will be initially on the surface of the solder.

Although there are three types of soldering fluxes, viz, chloride or acid, organic and resin/rosin, the last type is the only one which is more appropriate for use in electronic circuits assemblies. The others are extremely corrosive and lead to difficulties shortly after soldering.

The rosin fluxes have two features. They are non-corrosive and non-conductive. These two characteristics make them extremely adaptable to electrical and electronic work involving soldering. Use of such rosin fluxes have completely eliminated any corrosion attributable to the use of such a flux.

The first step in the selection of a flux is to find out which group of flux is suitable for the base material and then select the one which is most suitable and least corrosive for the soldering task. Most connections can be made using a mild flux which is electrically non-conductive. Where strong fluxes must be used, if all the residual flux deposits are not removed, progressive corrosion may result. The assembly must be capable of being adequately washed or cleaned.

Solder is one of the oldest and most widely used alloys. Its many uses and applications readily lend themselves to relatively simple techniques and processes. Yet this alloy is one whose properties are usually a subject of wide technical and scientific misunderstanding.

For hand soldering, solid or flux core wire can be used. If solid wire is used flux must be applied separately. In the core solder, the flux melts first, removes oxidation and prepares the surface for the molten solder.

Core solder is available in all the flux types used in other methods of soldering like rosin, organic acid and inorganic acid. Rosin core solder is normally employed in electronic applications. The flux percentage in the core solder, normally between one and four per cent by weight, can be varied though 2.5 per cent is most commonly used.

Solder

Solder is one of the oldest and most widely used alloys. Its many uses and applications readily lend themselves to relatively simple techniques and processes. Yet this alloy is one whose properties are usually a subject of wide technical and scientific misunderstanding. The somewhat limited technical knowledge many people have with reference to solder is even more marked in the case of soldering fluxes. In view of the fact that solder and its fluxes are fundamental to electronics, whether in industry or for a home hobby, it is not surprising to note that a great deal of the difficulties found in electronic equipments can be traced to poor soldering and/or poor solders and fluxes. Good soldering is one of the most important aspects to be kept in mind for assuming product stability. On the other hand, poor soldering can be traced back to the operator's lack of knowledge about principles and practices required for good soldering.

Soft solder is a fusible alloy whose basic components are tin and lead. Solder, as we know, is used to join two metals in a metallic union at a temperature well below the melting points of the metals being joined. Since soldering is exclusively on inter-metallic bonding that takes place between metals only, it is important that the metals be free from all non-metallic material, such as oxides which form on the surfaces of all ordinary metals. These oxides form an insulating layer that prevents good metal-to-metal contact in any soldering function.

The most common soldering alloy is tin-lead combination. However, consideration should be given to other fusible alloys covering a melting range of 117° to 600°F. These would consist of tin-lead, bismuth-indium, antimony-cadmium and silver combination. The alloy choice should take into consideration the operating temperature range of the equipment (the melting point of the solder should be well below this temperature). The soldering temperature is determined by the alloy chosen and care should be exercised so as not to exceed the temperature tolerance of surrounding materials. The strength and physical properties of the connection are determined by the solder alloy.

Tin-lead alloy by far comprises the largest single group and is the most widely used of the soldering alloys. Tin-lead solders are compatible with all types of base metal cleaners, fluxes and heating methods. Most metals can be joined with these alloys.

Increasing the tin content of these solders produces better wetting and flow characteristics. Thus, when less tin is used, greater care should be exercised in surface preparation of the metals to be joined. The general purpose solders of the tin-lead (35/65, 40/60, 45/55, 50/50) provide optimum wetting and flow properties, good strength at low temperature and the greatest ease of soldering. It is recommended that soldering experiment begin with 63/37, an 'eutectic alloy'.

The soldering temperature is determined by the alloy chosen and care should be exercised so as not to exceed the temperature tolerance of surrounding materials. The strength and physical properties of the connection are determined by the solder alloy.

The 60/40 solder is particularly suitable for delicate work (heat-sensitive components). The solder with highest tin content 70/40 is used for soldering zinc. It is suggested that eutectic alloy solder always be tried first since there is no plastic state and the control of inter-metallic formation is enhanced.

Wire solder is available in diameters from 0.038 cm to 0.318 cm. The diameter of the wire is selected by the size that will supply sufficient solder to the connection with maximum ease and speed of operation.

The flux percentage is determined by the amount that will provide sufficient but not excessive flux. One disadvantage with alloys composed of less than 60 per cent tin is the possibility of cracks forming during solidification due to the extended pasty range (plastic condition) of the alloys.

Solder properties and control

Solder usually consists of a tin and lead mixture. It normally melts between 183°C and 230°C. For PCB soldering, eutectic solder (melting point 183°C) containing 63 per cent tin and 37 per cent lead is used. Soldering work is normally done at about 250°C.

Tin, which is one of the components of metallic solder, is capable of having a good affinity for copper. The diffusion into copper takes place at a lower temperature than that for other metals such as iron, nickel and chromium and that too in a shorter period. Lead in the solder lowers the melting point of the compound and reduces the surface tension, while flux serves as an auxiliary agent for spreading the diffusion process.

Soldering problems

One of the most common faults in soldering is the application of insufficient heat. The solution or alloying action in soldering cannot be achieved without a uniform distribution of heat between the solder and the metal being soldered. If hot solder, for example, is applied to cold metal, or cold solder is applied to a hot metal, there can be no soldering action. Proper soldering can take place only when the metal being soldered is hot enough to maintain the solder in a liquid state. Anything less results in a 'cold' soldered joint.

It is very important to recognise that soldering depends on the amount of heat absorbed by the metal being soldered. A common source of problem results in attempting to solder a heavy piece of metal using lesser heat power.

METHODS OF SOLDERING

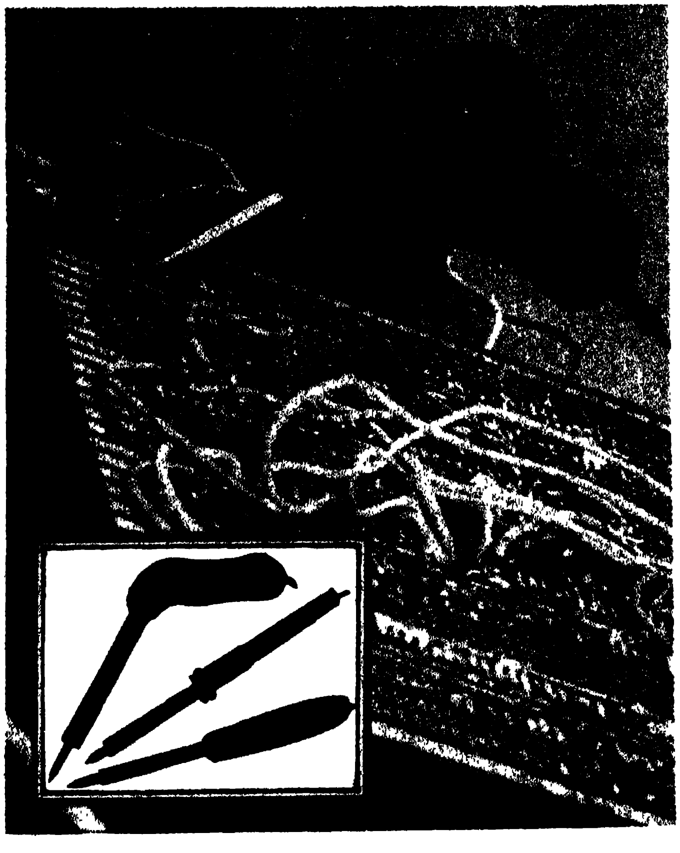
Hand soldering

Hand soldering is one of the oldest and most common methods of obtaining a solder joint. Over the last decade, hand soldering has improved substantially. Miniaturisation techniques have led to such innovations as double-sided and multi-large PCBs and plated-through holes to achieve a very high density of components in small areas. This has resulted in considerable reduction in the size of the soldered joints and today it can be as small as twentieth part of what it used to be some ten years ago. At the same time, new soldering irons have to be developed to obtain more reliable and consistent solder joints.

For most jobs, the ordinary soldering iron or pencil is most widely and effectively used. Yet care should be taken to select an iron with a wattage capacity that is adequate for the job. The tip, usually a solid bulk of pure copper, should first be cleaned and tinned with solder before any attempt is made to use it for soldering. Normally, the wear on the soldering iron tips is not due to erosion or the use of soldering flux. It generally results from the molten solder. Wear is usually dealt with by plating the copper tip with iron, but such tips are less effective in transferring heat to the metal being soldered. The most important point to remember is that the applied heat must be adequate to bring the metal being soldered to the alloying temperature.

The soldering iron must not only be capable of achieving small reliable solder joints with high production rate, but should also have a good temperature stability and fast thermal recovery. The operator of the iron has become an important specialist, usually self inspecting, to ensure that the solder flows correctly and that the correct amount of solder is applied.

Hand soldering has the basic advantage that where solderability of the lead or the PCB is not adequate, the operator will endeavour to overcome the problem with a little more solder or a longer 'dwell time' or a combination of both. This will positively give the desired results.



Conventional 60/40 solder melts at 188°C. It is well-known that the solderability temperature is 230°C. This is the lowest safe temperature at which a proper amalgam between the tin in the solder and the basic material can be obtained. In view of the thermal load of the joint, it is essential that the soldering iron temperature be substantially above 230°C to avoid a long dwell time.

The majority of soldering irons, therefore, have a tip temperature around 370°C under idling conditions. The higher temperature also reduces the possibility of oxidation of the solder on copper before the joint is achieved, as the flux is brought out of the cored solder must faster.

Flux core solder is a combination of solder and flux which are substances with very different physical and chemical properties. Taking into account this dissimilarity, flux core solder is applied according to a technique that provides for the simultaneous release of both substances at a single point where the action of both is desired. This technique can be defined as "the application of the flat surface of the adequately heated soldering iron directly against the assembly and the simultaneous application of flux cored solder strand at the exact point of iron contact."

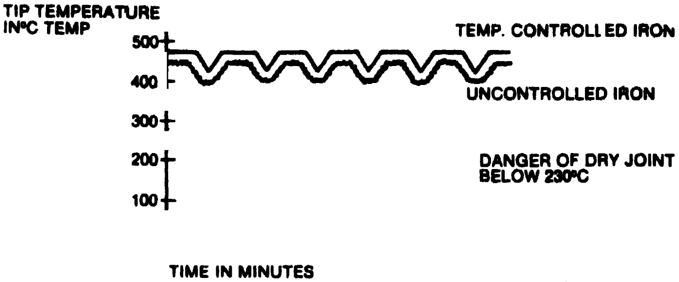


Fig. 1: The recovery from repeated thermal loads for 10 sec. followed by 3 sec. recovery.

Thermal recovery and temperature control of soldering iron

To enable the operator to solder continuously at a high rate, it is very necessary that the soldering iron has a very high thermal recovery rate. If it is not so, the tip temperature would reduce every time it is applied to a joint, thus lending itself to longer dwell times, and ultimately to dry joints. This is a distinct possibility if the tip temperature falls below 230°C (Fig. 1).

On the other hand, if soldering iron has a very fast thermal recovery rate without any limiting arrangement, the temperature would rise out of control whilst the iron is at rest.

Hence, an operator with a temperature-controlled, fast thermal recovery type of soldering iron can make a solder joint at a much faster rate without any damage to the pattern in the PCB or component joint. If the temperature of the soldering iron can be varied, then it is capable of being used in many different applications for soldering components especially those which are extremely sensitive to higher temperatures. A self inspecting operator is most important, as he will vary his approach to each individual joint according to the conditions of use.

Factors affecting time/temperature relationship

The temperature reached by a specific component within a specified period of time is dependent on a variety of factors and their combinations. Each component type must be judged separately because of differing sensitivity to temperature.

Printed wiring board and component lead solderability. The rate at which the solder joint is made depends on the degree of lead solderability. The poorer this is, the greater is the time required to make the solder joint and therefore, the higher the internal temperature of the component. The solderability of the PCB is also significant. The solderability is, among other things, dependent upon control in preparation, time in storage conditions and handling techniques.

Component lead diameter and length. On a PCB where various diameter component leads are involved, the component with the smallest diameter lead reaches a higher temperature than the larger diameter lead component.

Component and material. Although for practical purposes this variable may be small, thermal conductivity of materials does vary.

Flux activity. The higher the flux activity, other factors being equal, the faster the completion of good soldered joint, and hence lesser the total heat input to the joint.

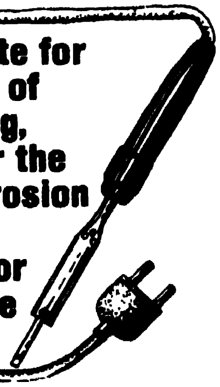
Type of solder alloy. Flow characteristics are determined by the type of alloy. The dwell time needed to complete a good connection must be varied to suit the alloy chosen.

Degree of solder contamination. As can be expected, relatively small additions of metallic contaminants to the tin-lead solder change the surface energies of the resulting alloys, and thus influence the wetting characteristics.

Wetting action

The mechanism by which solder bonds to solderable metals is a complex phenomenon and involves chemical, physical and metallurgical forces and effects. These are such that they require the establishment of extremely close contact on an inter-atomic level between the solid and liquid metals. This requirement calls for the absence of any kind of contamination which could interfere with these requirements on both the solid and the liquid metal surface. Without appropriate cleanliness, proper bonding does not take place between the base metal and the solder, or using the metallurgical term, the solid metal will not be 'wetted' by the solder.

Wetting is a prime requisite for reliable solder joints. It is of equal importance in tinning, without regard to whether the coating is applied for corrosion protection to retain the solderability of the wire, or as an aid in performing the soldering operation itself.



Wetting is a prime requisite for reliable solder joints. It is of equal importance in tinning, without regard to whether the coating is applied for corrosion protection to improve or retain the solderability of the wire, or as an aid in performing the soldering operation itself. The degree, extent and rate at which wetting takes place are used as the criteria to determine the solderability of a metal surface. Together with proper joint design, wetting causes the molten solder to be drawn into the joint by capillary action and held there till it solidifies.

So the soldering operation should be performed at the lowest possible temperature and in the shortest possible time. The better the solderability of a metal surface, the nearer this thumb rule can be followed.

Soldering irons

The heating method best suited to the base materials, solders, and fluxes chosen should be used. Since this concerns hand soldering, it deals primarily with the use of conduction type of soldering irons.

Most soldering irons for hand soldering electronic assemblies are heated electrically. They consist of an electric wire attachment, a heating element, a tip for heat transfer and an insulated handle. The tip, normally copper because of its high heat conductivity, is often plated with nickel or iron to increase life.

Flux and molten solder dissolve a copper surface more readily than an iron or nickel surface. However, iron or nickel clad tips require slightly more heat input to compensate for their lower heat conductivity. In some cases, because molten solder cannot wet chromium, the top part of an iron or nickel clad tip is chromium plated. Such a plating confines molten solder to the edge of the tip.

Types of soldering irons and guns

Decision with regard to use of guns versus irons will depend upon the intended functions and the operating methods. Many soldering operations can be performed by either of these portable types, but each has specific advantages. However, it should be noted, that to avoid damage to sensitive components of solidstate equipment, gun designed for this specific soldering purpose only should be used.

The gun, because of its trigger control, gives almost instant heat at either its low or high output level, and cools quickly for storage or to lessen the danger of accidental burning when laid aside. The tips on the guns are usually smaller than on the irons, hence this type is most practical for use in hand-to-reach areas and for intricate repairs and assemblies. The better quality, high output models incorporate twin built-in lamps on either side of the tip to illuminate the work area.

Soldering irons for professional use and industrial grade are available in different types. There are irons with output ratings of 6W, 8W, 12W, 25W, 40W, 60W, 100W, 150W etc. Selection of an iron depends upon the type of use for which it is being put to. Temperature sensitive components call for higher wattage irons. There are also irons with fixed tip temperature for field use. Irons, which are portable and have

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controlled output rated at 60 or 100W with interchangeable tips, are also in use for specific demands.

Professional soldering irons, generally selected for periods of longer continued use and to perform heavier duty operations have a decided weight advantage on guns to the extent of about 25 per cent.

Another point of interest to note as regards use of soldering irons is that soldering irons when new operate efficiently, but a fall off appears in a relatively short time due to build up of oxidation on the element bobbin and in the bit-chamber. This, unfortunately, is not self rectifying and the more the iron is used, the less efficient it becomes. This build up of oxidation then acts in reverse as a heat insulator between the element and soldering bit and has the effect of greatly extending the heat recovery cycle, thus reducing the spread of operation.

Apart from loss in production time, oxidation causes one of the greatest problems encountered with soldering irons, i.e. bit seizure resulting in considerable difficulties. Due to the difficulties involved in removing the bit, the operator is usually required to spend considerable time in separating the two elements, often resulting in damage. Furthermore, during such period the iron is non-productive and perhaps an operator idle.

Soldering iron tips

A soldering iron tip consists of high purity copper, iron plated 0.0153 cm to 0.762 cm thick, hot tin-dipped in the working area and the remaining surface immunised by nickel-chromium plating. The working area of the tip is usually fabricated for access and maximum heat transfer to the work point. There are a number of standard point configurations available for most soldering irons. The various shank configurations are: (a) plug (fitting in a cylindrical heating well), (b) threaded (internal and external) and (c) sleeve (fitting over a heating mandrel).

For many years, soldering tips were made from high purity copper without additional plating protection. Due to the high solubility of copper in molten tin, pure copper tips quickly deteriorate and must be reshaped by filing. Iron plated copper tips have a life of 20 to 50 times that of pure copper and require no filing. However, these bits gave a basic disadvantage in that iron is a bad conductor of heat compared to copper and can give rise to a heavy deposit of iron which can reduce the operational speed of a bit.

In general, soldering tips are placed in a soldering iron that is hand-held by an operator. However, there are special machine applications for custom-made soldering tips. Quality of a soldering tip is measured by its life in service and its resistance to shank corrosion which could result in the 'bit-seizing' to or in the iron.

Soldering iron tip design

Emphasis has always been placed on the selection of the soldering iron, with too little attention paid to the design of the soldering iron tip. There are four tip factors that must be considered to assure maximum flow of heat, thus permitting the greatest rate of productivity for reliable connections at minimal cost. These are: (a) tip length, (b) frontal size (mass), (c) contact area and (d) tip diameter (Fig. 2).

Tip length. In order to assure the greatest flow of heat from the element (heater) to the working face of the tip, it is recommended that the tip be as short as possible. On a standard 6.4 mm tip, it is a rule of thumb, to decrease tip temperature to 40°F per cm of length added to tip.

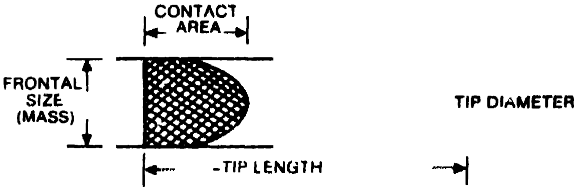

Fig. 2: The design of soldering iron tip.

Frontal size (mass). Every effort must be made to utilise the largest frontal size possible. Long turned down tips are liable for losing heat retention and transfer property which are extremely important in maintaining constant heat output. A point face tip with a control taper is far more efficient.

Contact area. All the heat from the iron and tip must be transferred to the solder connection through the tip contact area. Therefore, more the interface between tip and solder connection, the shorter will be the dwell time. It is of greatest importance to note that the tip must be readily tinnable. It must maintain a solder coat at all times since it is the solder that actually transfers the heat to the connection.

Tip diameter. The tip should be copper based with electro-deposited high grade iron on the point end. The back of the tip must be stainless steel coated. This prevents the tip from sticking in the iron. The point face should be tinned with tin/lead solder.

Proper use and care of a soldering iron tip is an important factor for increasing production and decreasing solder joint failures. Some general rules to follow are: (a) the working surface must be tinned at all times, (b) excess solder must be kept on the tip during prolonged idling periods, (c) flux residues and plastic wire residues must not be allowed to accumulate on the tip.

Most soldering irons tips are tinned by the manufacturer. However, when proper soldering procedures are not followed, a tip will de-tin or de-wet. The tip should then be removed and cleaned suitably. Once the oxides are removed, the tip can be re-tinned.

Wattage ratings of soldering irons

The wattage rating of iron is an indication of how much electrical energy is converted into heat, but it is an extremely unreliable indication of how much heat a tip can transfer to work. The temperature that the iron can quickly transfer to and maintain on the surfaces to be soldered, is the most important consideration. The efficiency of an iron determines the quantity of energy generated as heat which reaches the working tip and the solder area. Heat content is a measure of the caloric content of the soldering iron that is available for the soldering operation. It is dependent on the specific heat of the various metallic conductors that are present between the heating element and the work.

Another factor involved in hand soldering is the recovery rate of soldering iron. This is the amount of time necessary for a tip to regain its maximum tip temperature after the heat is drained out during the working cycle. As most of the soldering tasks on PCBs are low quenching type connections, it is relatively easy to assure temperature stability and therefore provide a very narrow thermal zone. If dwell time is reduced and the right soldering iron with the thermal capability to do the job without excessive thermal loss is used, a condition very similar to that found in wave soldering process can be achieved, i.e. precise control of time and temperature.

Selection of soldering irons

The attributes given below must be ensured in selecting the proper soldering iron and tip to match the soldering task to be carried out.

Mechanical (bio-mechanics). The mechanical properties are: (a) length, (b) weight, (c) balance, (d) directional control, (e) aesthetics, (f) safety and (g) comfort.

The mechanical attributes are probably easiest to satisfy. The iron should suit the type of soldering task to be performed. If working in microelectronics, it would be advisable to use the shortest, lightest and the best balanced iron. Directional control is extremely important in such work because the proximity of the hand to the working tip increases the ability of the operator to direct the tip to the tiny task. If the iron is long and cumbersome, additional direction restrictions are imposed on the operator. Aesthetics comes into play more and more since many operators like pleasantly coloured modern irons.

These parameters above mostly cater to comfort. Safety also should be considered. The iron should be constructed so that it can be held easily and securely to avoid slippage and possible burns. The line cord should be three-wired and made with a high temperature abuse resistant material. It should be non-burning to prevent instantaneous shorting if the operator should inadvertently place the iron on the line cord.

Electrical. These are: (a) leakage and (b) grounding. The iron should be constructed so that it provides electrical safety both to the component and the operator. Safety to the component means zero leakage between the iron and the part to be soldered. This can be accomplished with a proper grounding which eliminates the possibility of transient voltages. The tip is actually grounded to the third wire in the line cord. The iron should be of three-wire ground construction to provide safety to the operator. This is extremely important for irons that are to use 220 to 240V.

Thermal (heat capacity). With the help of a soldering equipment analysis it is possible to measure, under dynamic conditions, what exactly happens to the tip temperature under load. Temperature, wattage and voltage can also be measured.

Voltage variations

Variation of input voltage to soldering iron changes the tip temperature at idling and under working conditions.

Desoldering tools basically consist of a soldering iron and another means for removing the solder from joints. Suction devices vary from simple plastic tools with springs and plunges to more sophisticated industrial grade tools.

Table 1 indicates the extent of wattage changes on a 40W, 50W and 60W soldering iron with a variance in input.

TABLE 1

Rated Wattage	Actual Wattage					
	220V	224V	230V	236V	240V	246V
40W	36	38	40	42	44	46
50W	45	47	50	52	54	57
60W	55	57	60	63	65	68

Line voltage variations should be corrected using voltage stabiliser. Soldering irons using correct voltage promote long element and tip life, ensuring a proper and reliable soldering joint.

Desoldering tools

Having considered certain soldering methods above, it is essential to understand as part of maintenance and repair activity, details of desoldering techniques and tools also.

Desoldering tools basically consist of a means for melting solder such as a soldering iron and another means for removing the solder from joints. Suction devices vary from simple plastic tools with springs and plunges to more sophisticated industrial grade tools.

Another popular means of removing solder are wicks which consist of copper braid impregnated with non-activitated flux. All sizes and types of joints or connections can be desoldered by placing the proper size wick braid on a connection and using a regular soldering iron at operating temperature. The iron tip is placed on this braid and within one second the solder is drawn up into the braid leaving the joint clean. Solder does not have to be heated beyond its melting point since it flows to the wick as soon as it is liquid.

The braid acts as a heatsink and prevents overheating as well as the resulting damages to circuitry or components —the non-activitated flux coats the pad and plated through hole. This prevents oxidation to the circuitry until it is desoldered. The braid is available in different sizes on spools for various sizes of pads and amounts of solder involved.

Vacuum type desoldering permits one hand operation by mounting the vacuum device into a soldering iron so that solder can be melted and vacuumed into a convenient collector with a single unit. The vacuum device may be a squeeze type built with a one way check valve or may consist of a vacuum transducer which converts compressed air into instantaneous vacuum.

OTHER SOLDERING TECHNIQUES

Wave soldering

Apart from hand soldering, techniques such as dip, reflow and wave soldering are also widely in use. All these techniques have a common characteristic, viz, the solder is supplied to the joint area in molten form. The heat source in hand soldering is the soldering iron. In dip and wave soldering it is the hot solder itself

In the reflow soldering technique, the solder is pre-applied to the joint surface as a coating or is introduced into the joint space as a solder paste/cream, or preform which may or may not include the flux. Soldering then is performed by fusing together the precoated surfaces or by melting and bonding the pre-applied solder in the joint inter space.

The principle of wave soldering is based on a continuously circulated, gently over-flowing, standing wave of liquid solder. As both heat and solder source is continuously circulated the molten solder offers superior thermodynamic and metallurgical performance compared to a static bath. A well functioning solder wave, which is a junction of geometry, thermodynamics and fluid mechanics, will contribute to the wetting of the joining surfaces, promote through-hole penetration and assure formation of reliable solder joints.

The typical wave solder system includes fluxing, preheating and soldering with a means of conveyance.

Dip soldering

This incorporates a controlled dip process developed for tinning and/or soldering axial and non-axial parts. The solder dipping operation can be automated when integrated with a fluxing station and conveyor. Applications for controlled dip type soldering systems include tinning of resistor, capacitor, transistor and diode leads and terminals.

Ultrasonic soldering

Ultrasonics permit fluxless soldering and tinning of non-ferrous materials with no chance of residual fluxes causing future corrosion and failure of part. Soldering, fluxing and consequent post-cleaning operations are eliminated.

Ultrasonics can be used for soldering of metals considered very difficult to solder properly, such as nickel alloys. The soldering of materials such as aluminium wire, often considered as unsolderable on production basis, can be accomplished with ultrasonic soldering.

Ultrasonic soldering is used to solder or pre-tin flat packs, DIPs, wire, axial lead components, small PCBs etc.

Ultrasonic soldering is a mechanical method of oxide removal, creating ultrasonic vibrations in the molten solder. This action of the solder sends the oxide from the metal surface. No new oxides can form on the part since no oxygen is present in the molten solder bath. Once the oxides are removed, a metallurgical bond is created between the base metal and solder alloy.

Roll tinning

Roll tinning machines are designed to coat PCBs with solder in order to improve shelf life and circuit solderability. The tinning of the PCB is achieved by the transfer of solder from a precision metallic roller which is partially immersed in the solder batch. A silicone rubber covered pressure roller assumes contact between the circuit surface and tinned metallic roller.

Although many automated soldering processes have been developed and are being used, hand soldering is still one of the most practical methods. Its low initial equipment and set up costs and ease of training operators make it very effective for use with new materials and packaging techniques. □

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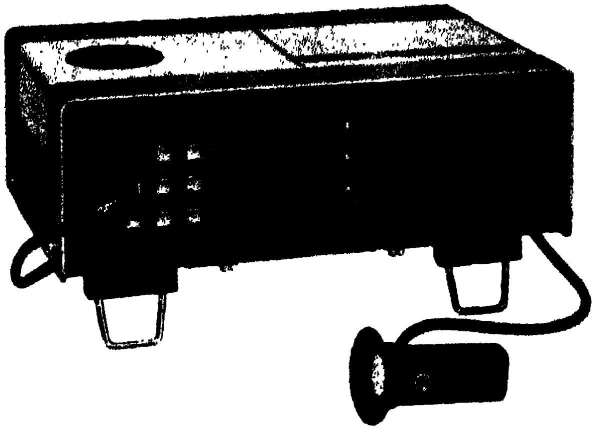
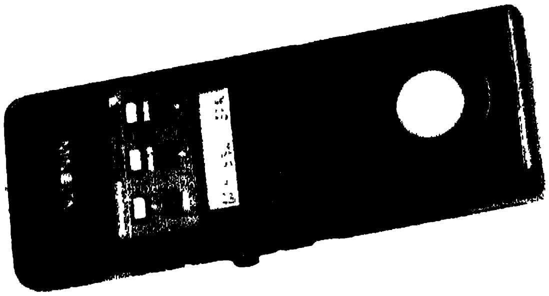


Enables objective white-balance measurement and adjustment of monitors in TV production lines and broadcasting studios. Incorporation of a chroma mode in addition to a primary-analyzer mode eliminates the need to use a troublesome white master or comparator for inputting the desired white standard into memory. This versatile analyzer can also be used for color adjustment of computer CRTs and video projectors, as well as R&D testing of new products.



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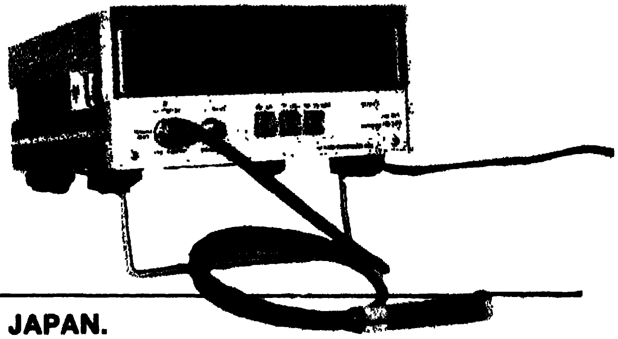

The model VM-161A is a digital RF voltmeter which can measure a wide range of voltages, ranging from 20 Hz to 1,200MHz. LF low frequency measuring part and RF probe high frequency part have independent input terminals respectively. LF covers the frequency of 20Hz to 100kHz and the voltage of 1mV to 20V r.m.s; while RF probe covers the frequency of 10kHz to 1,200MHz and the high frequency voltage of 3mV to 10V r.m.s. with use of detection probe.

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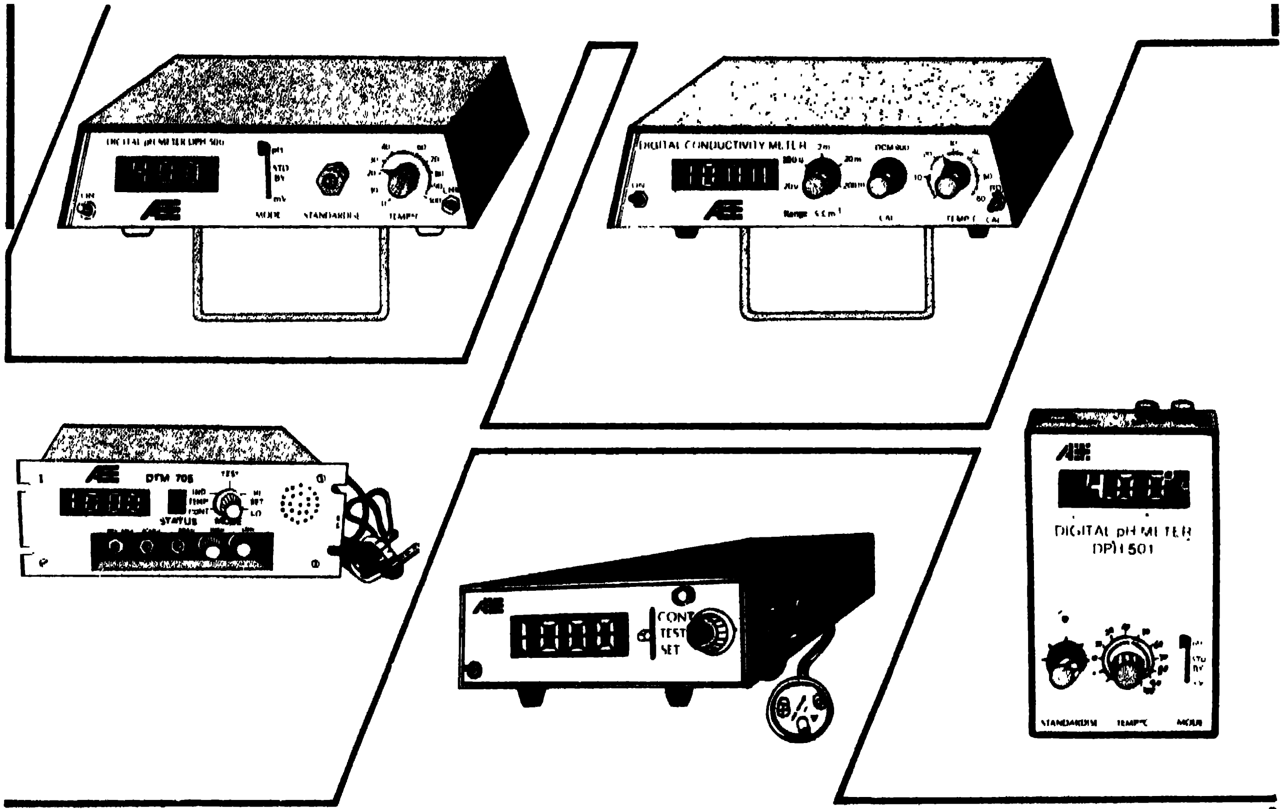

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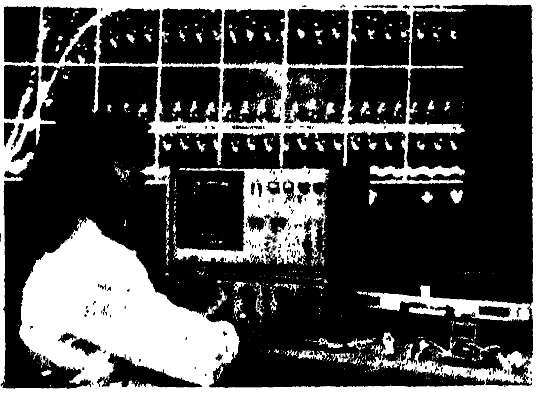

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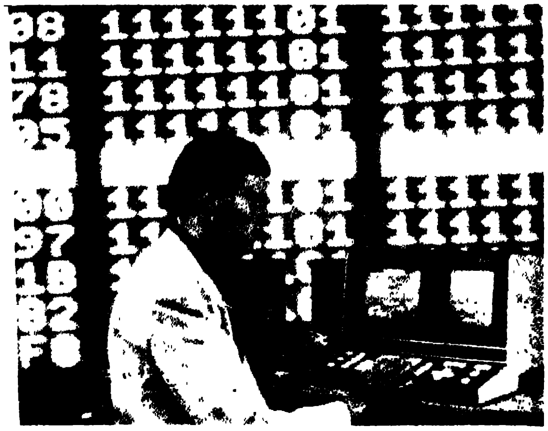

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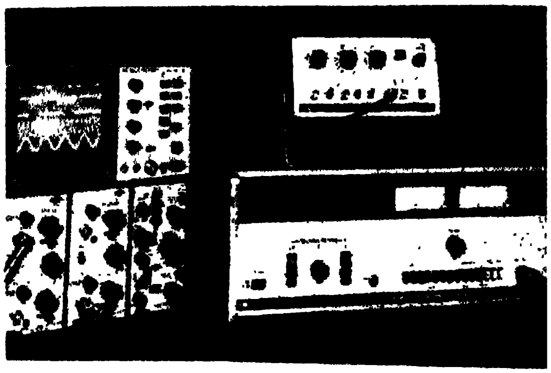

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CMOS LOGIC ICs

Part III-CIRCUIT IDEAS

In the preceding articles of this series, we have studied in detail the characteristics, behaviour and methods of use of CMOS logic devices. The knowledge we have gained would be useless if it is not put to use. At this stage, one point must be made clear. Although it was stressed in the previous article that CMOS devices should be handled with care, this does not mean that they are so delicate that the hobbyists and other users are scared off from using them!

People who may feel afraid to use them, have just not understood what was said – all devices have a built-in protection against a wide range of handling conditions, but still they must be used carefully so as to avoid unexpected failure and corresponding disappointments. So if one just avoids touching the IC pins, uses a well-insulated soldering iron and follows some of the general operating procedures, it is usually sufficient to work with these ICs, in the average case under normal environments of a laboratory (though not for industrial production which demands high reliability). So, a fresh look at CMOS for all your requirements will show the benefits they give you.

Coming to the actual application, it is not necessary to describe the applications of each gate and IC, since they are functionally identical with similar TTL devices, which users are assumed to be familiar with. Further, individual ICs are described better in the manufacturers' data sheets. The same logic system design procedures usually adopted for TTL ICs stand for the CMOS devices, except for specific differences like voltage levels, current, speed, pin connections etc. Thus, here we will discuss more about circuit designs which utilise the specific characteristics of CMOS devices.

Pulse circuits

CMOS digital gates find a wide application in pulse generation and shaping circuits. The circuits described here, can generate fixed width pulses corresponding to a given pulse train input. The output pulse width, in some cases, depends entirely on the characteristic of the CMOS gate used while in other cases, it depends on external RC connections.

Pulse stretcher. The circuit in Fig. 1 can be used to obtain pulses of specified width from narrow input pulses. A positive pulse at the input causes the inverter output to be low, discharging the capacitor through the diode D1. The capacitor is rapidly discharged so that the Schmitt trigger inverter input is brought too low and the output goes high. Check that the size of capacitor is small enough so that it can be rapidly discharged within the period of a narrow input pulse. This implies that,

$$\text{Inverter current sink} > \frac{.V_{CC}}{t} + \frac{V_{CC}}{R}$$

where t is the input pulse width. When the inverter input returns to zero, after time 't' seconds, the diode blocks the inverter from charging the capacitor, which is charged from the supply through the resistor. When the Schmitt input reaches its upper threshold level V_{T+}, the output goes low and remains in this state until another pulse comes to the input. Thus the output pulse period is given by

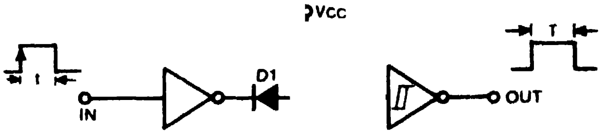


Fig. 1: Pulse strecher.

$$T = RC \log_e \left(\frac{V_{CC} - V_D}{V_{CC} - V_{T+}}\right)$$

where V_D is the diode drop (0.6 V for silicon diodes).

Monoshot. The circuit of Fig. 2 is a monostable multivibrator. Normally, the input is zero and the first NOR gate output is high, keeping the capacitor discharged. Since the second NOR gate input is also high, its output will be low,

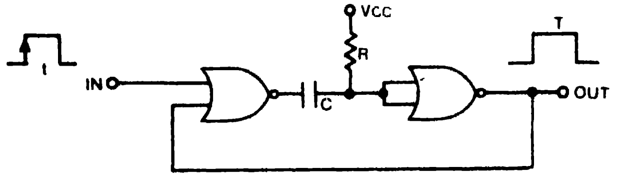
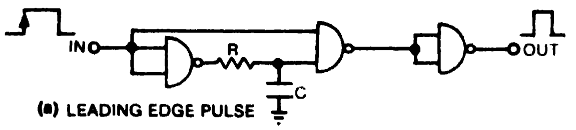


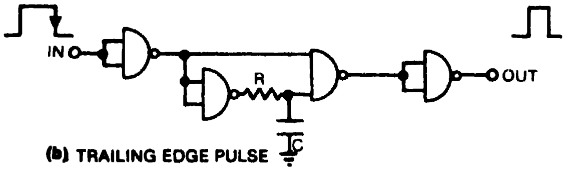
Fig. 2: Monoshot.

which confirms again that the first NOR output will be high.

When a high pulse appears at the input, the first NOR output immediately becomes low, bringing the second NOR input also to low state. This gives a high output, which is fed back to the input NOR. Now the capacitor starts charging from Vcc through the resistor and the first NOR output, slowly raising the input voltage to the second NOR.



(a) LEADING EDGE PULSE



(b) TRAILING EDGE PULSE

Fig. 3: Digital differentiator.

In the meanwhile, even if the input pulse has disappeared, the input NOR output remains at low, due to the high state output feedback. After a period T, the second NOR input rises above the logic high level and the second NOR output swings to low state. This brings the first NOR output back to the high state, and the circuit comes back to the original condition. The output pulse duration is given by

$$T = 1.4\ RC$$

Digital differentiator. Differentiators are used to produce a narrow pulse at the edge of a wider pulse. The circuit of Fig. 3 can produce such pulses either at the rising edge or falling edge of the input. In Fig. 3(a), when the input goes high, the first inverter output goes low. This is delayed by the RC filter and the delayed low-going pulse is fed to the output AND logic. Thus, the output will be high only for the duration of overlap between the two inputs, which corresponds to the delay produced. Thus a small pulse appears corresponding to the rising edge of the input.

In Fig. 3(b), the input signal is inverted, thus the output pulse corresponds at the falling edge of the input signal. For producing the delay, the RC elements can be replaced by a chain of CMOS gates, whose total combination does not invert the signal flowing through, but produces sufficient delay at the output due to the propagation delay of each gate.

Frequency doubler. The principle of delay can be used to double the frequency of any square waveform, as shown in Fig. 4. The input square wave signal is buffered by the first EXOR gate before being fed to the delay RC network. The delayed waveform is now EXORed with the input waveform to produce the output. This will be high only when one of the two input signals is high. Hence, a pulse will be produced at each edge, whose width corresponds to the delay produced.

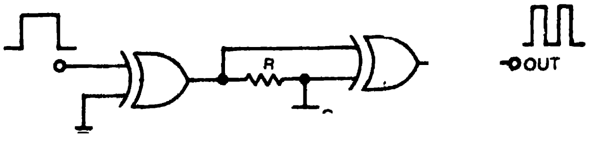


Fig. 4: Frequency doubler.

Thus, if the input is a square wave, the output will be a train of equally spaced pulses, with frequency double that of the input. As in the previous case, the delay element may be replaced by a chain of gates.

Linear application

As we have seen earlier, the CMOS inverter can be biased for operating in the linear mode. Thus, any CMOS inverting gate can be used in many of the common amplifier applications. Even without biasing the inverter, it can be used as a voltage comparator for numerous linear applications. A few such circuits are described here.

AC amplifier. Three CMOS inverters can be suitably biased for use as an AC amplifier with a gain of ten as shown in Fig. 5. Actually, the higher the open loop gain is achieved, the more accurate will be the closed loop gain. The open loop gain is multiplied by the number of stages (which must be an odd number) used inside the feedback loop.

Integrator. A shown in Fig. 6, CMOS inverter can be biased to operate as an integrator for AC signals, with an integrating time constant of RC.

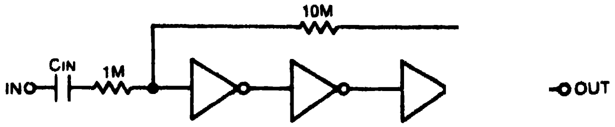


Fig. 5: AC amplifier.

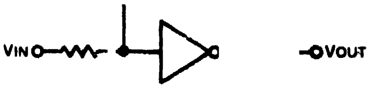


Fig. 6: Integrator.

Post amplifier. Low power op-amps can be buffered with an CMOS inverter. This gives the advantage of operating the op-amp under no load condition with full voltage swing frequency capability and low power loss. Such a circuit is shown in Fig. 7. This circuit uses the low power advantage of both devices. At the output, more inverters may be paralleled (six inverters come in a single package) to obtain

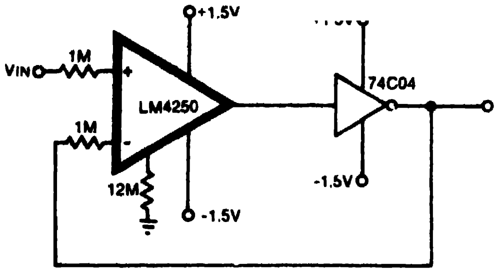


Fig. 7: Post amplifier.

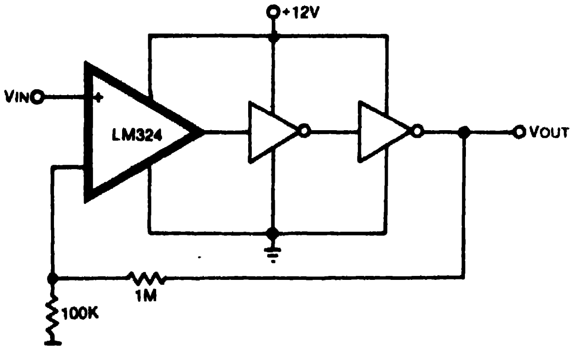
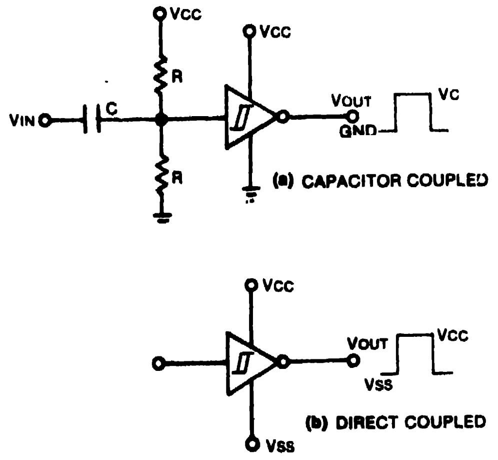


Fig. 8: Single supply amplifier.

increased current drive, even for ordinary op-amps, operating within the supply limits of ±7.5 V.

Single supply amplifier. The CMOS inverter can also be used with single supply op-amps such as the LM324 as shown in Fig. 8. The CMOS inverters can be paralleled for increased power to drive higher current loads. Loads of 5 mA per inverter can be expected under AC operating conditions.



(a) CAPACITOR COUPLED

(b) DIRECT COUPLED

Fig. 9: Voltage comparator.

Voltage comparator. A CMOS inverter with Schmitt trigger input can be biased to operate as a voltage comparator, within the range of its threshold voltages. Typical circuits are given in Fig. 9. The circuit of Fig. 9(a) biases the input to half the supply voltage and the input AC signal to be compared is coupled through the capacitor. The output is a rectangular wave, swinging in accordance with the voltage comparisons. The capacitor impedance at the lowest operating frequency should be much less than R/2. The circuit of Fig. 9(b) uses a split supply voltage between ±1.5 to ±7.5V, so that the input AC waveform can be directly coupled.

Light activated switch. A simple light activated switch can be made as per the circuit of Fig. 10. Since the input impedance of the CMOS is very high, input biasing is very easy. Only one LDR and a preset potentiometer is needed for sensing. The LDR and potentiometer forms a potential divider whose mid-point is biased suitably by adjusting the potentiometer, so that the inverter switches for the desired illumination. After that, whenever light falls on the LDR, the mid-point voltage rises as light intensity increases. When the upper threshold voltage is reached the inverter output will become low and remain low until the light intensity is reduced significantly.

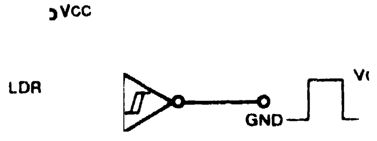


Fig. 10: Light activated switch.

Oscillators

At last we come up with a wide variety of CMOS oscillators to suit your various applications. These circuits offer the following advantages:

i) Guaranteed self-start
ii) Good stability with respect to power supply variations
iii) Wide operating supply voltage range (3V to 15V)
iv) Wide operating frequency range (less than 1 Hz to about 15 MHz)
v) Low power consumption
vi) Easy interface to other logic families
vii) Symmetrical output waveform (due to symmetry of output transistors)

Both RC and crystal oscillators are described here. The stability of the RC oscillator is sufficient for most applications. Certain applications, like time-keeping over long intervals, require crystal oscillators.

Single gate oscillator. The circuit of Fig. 11 is the simplest possible oscillator, using one Schmitt trigger input CMOS

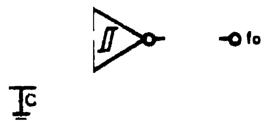


Fig. 11: Single gate oscillator.

inverter The capacitor is charged and discharged through the inverter output in accordance with the gate input swings between the two threshold voltages, V_{T+} and V_{T-}. The output frequency is given by

$$f_o = RC\log_e\left[\frac{(V_{CC}-V_{T-})}{(V_{CC}-V_{T+})}\quad\frac{(V_{T+})}{(V_{T-})}\right]$$

Two gate oscillator. The circuit of Fig. 12 uses two ordinary CMOS inverters to form a square wave oscillator. The only disadvantage of this circuit is that for low values of the capacitor, the circuit may not oscillate at all. The output frequency is given by:

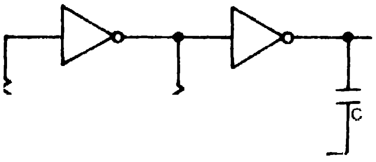


Fig. 12: Two gate oscillator.

$$f_o = \frac{1}{1.4\ RC}$$

Three gate oscillator. To overcome the problem of the earlier circuit, another inverter is added to the circuit so that it will always oscillate. The circuit is shown in Fig. 13, using three inverters. Actually any inverting CMOS gate or combination of gates can be used. The output frequency is given by:

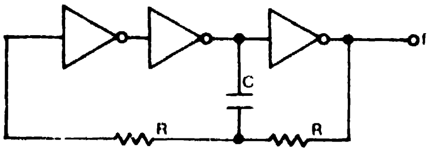


Fig. 13: Three gate oscillator.

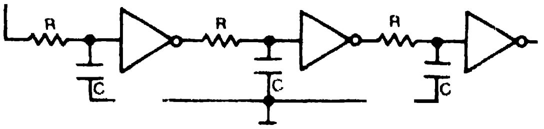


Fig. 14: Phase shift oscillator.

$$f_o = \frac{0.56}{RC}$$

Phase shift oscillator. A phase shift oscillator using three CMOS inverters is shown in Fig. 14. The output frequency is given by:

$$f_o = \frac{1}{3.3\ RC}$$

Crystal oscillator. Fig. 15 illustrates a crystal oscillator using only one CMOS inverter. Any odd number of inverters can be used, but due to propagation delays, fewer inverters give maximum possible frequency. At the crystal frequency the feedback resistor biases the inverter for linear operation while the output frequency can be trimmed to a small extent by either of the two capacitors.

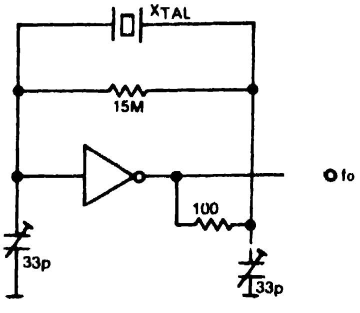


Fig. 15: Crystal oscillator.

Voltage controlled oscillator. A simple VCO is shown in Fig. 16, using a CMOS inverter as an integrator, a CMOS Schmitt input inverter as a comparator with hysteresis and a transistor as a discharge switch. The inverter integrates the positive difference between its threshold V_{IH} and the input voltage V_{IN}. The output is a ramp till the positive threshold V_{T+} of the Schmitt trigger is reached. Now the Schmitt output goes low, giving a low going pulse output and turning on the transistor switch. This discharges the capacitor through R_D while hysteresis keeps the switch on. Resistor R_D must be kept much smaller than RC to keep reset time negligible. With the capacitor discharge, the inverter output voltage falls, and when this becomes equal to the negative threshold V_T of the Schmitt input, the output becomes high and the transistor turns off. The cycle is repeated with a frequency given by

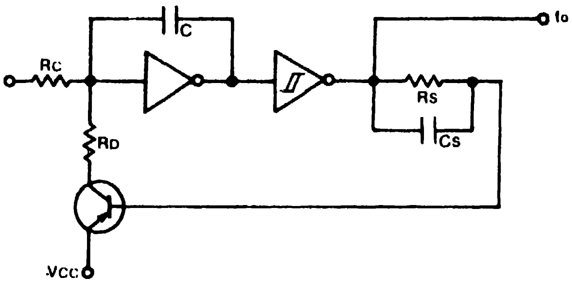


Fig. 16: Voltage controlled oscillator.

$$f_o = \left(\frac{V_{IH}-V_{IN}}{V_{T+}-V_{T-}}\right)$$

where $0 \quad V_{IN} \leq V_{CC}$

The frequency dependence with voltage is given by

$$\frac{\Delta f_o}{\Delta V_{IN}} = \frac{-1}{(V_{T+}-V_{T-})R_CC}$$

where the negative sign indicates that maximum frequency will be obtained for V_{IN} equal to zero and frequency will decrease with increase of V_{IN}. At V_{IN} equal to V_{IH}, approximately 0.55 Vcc, the circuit will finally stop oscillating.

(To be continued)

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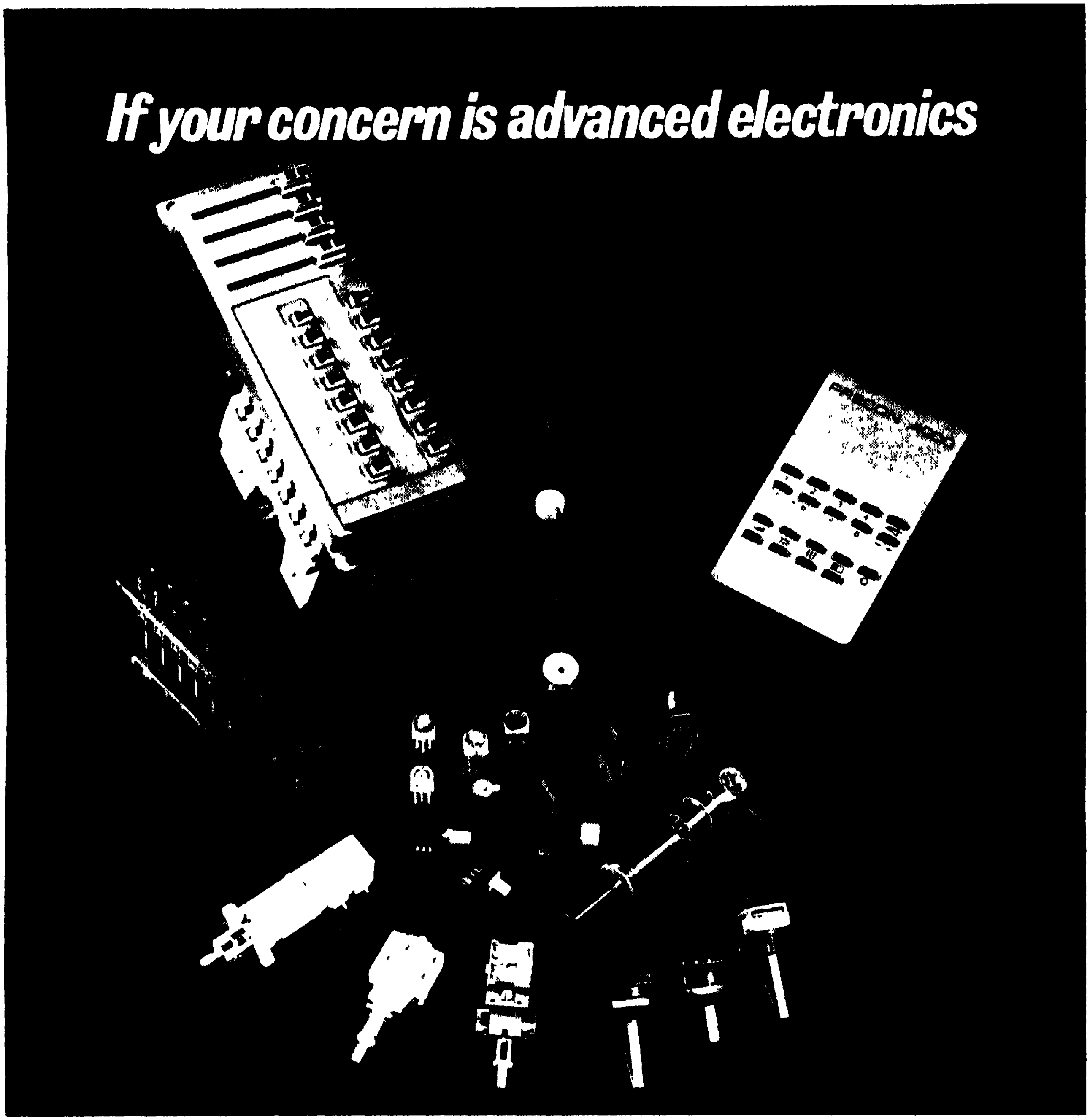

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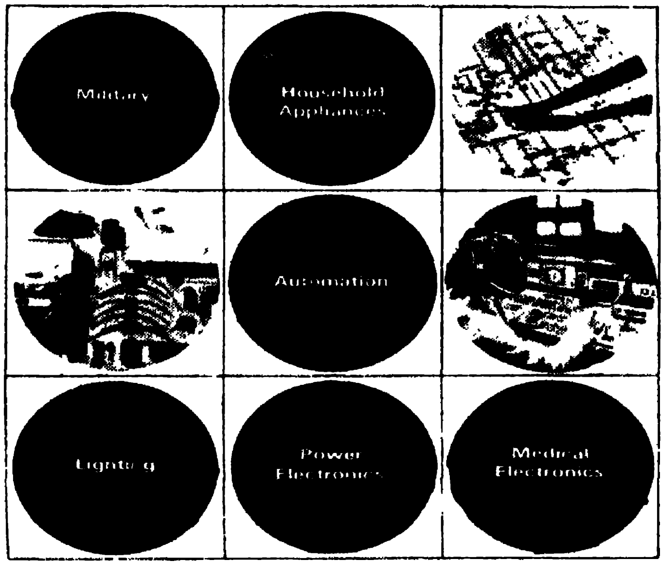

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A Safety Guide To Television Users

M. Achutan

Safety instructions for the user are provided with each television receiver. Instructions warn the user of hazards and state the precautions that ought to be taken to guard against such hazards. The safety istructions are available in the form of a separate booklet r sheet or may be part of the instruction manual.

The safety instructions include the following conditions nd warnings.

1. Read all the instructions.
2. Preserve instructions for later use.
3. Unplug the television receiver from the wall outlet efore cleaning. Use damp cloth for cleaning. Do not use iquid cleaners.
4. Do not use attachments not recommended by the television receiver manufacturer as they may cause hazards.
5. Do not use the television receiver near water, e.g. near a bath tub, wash bowl, kitchen sink or laundry tub, in a wet basement or near a swimming pool.
6. Do not place the television receiver on an unsuitable trolly stand or table. The television receiver may fall, causing serious injury to personnel and serious damage to the appliance. Use only stands recommended by the manufacturer or sold along with the receiver. Wall or shelf mounting should follow manufacturer's instructions and should use mounting kit approved by the manufacturer.
7. Slots or openings in the cabinet and the back or bottom are provided for ventilation to ensure reliable operation of the receiver and to protect it from overheating. Hence these openings must not be blocked or covered. The openings should never be blocked by placing the television receiver on a bed, sofa, rug or similar surface. The television receiver should never be placed near or over a radiator. The television receiver should not be placed in a built-in installation such as a book case unless proper ventilation is provided.
8. The television receiver should be operated only from the type of power source indicated on the marking label. If you are not sure of the type of power supplied in your home, consult your television dealer. For television receiver designed to operate from battery power refer to operating instructions.
9. With television receivers equipped with polarised AC current line plug (a plug having pins of different sizes), the plug will fit into the power outlet only in one way. This is a safety feature. If you are unable to insert the plug fully into

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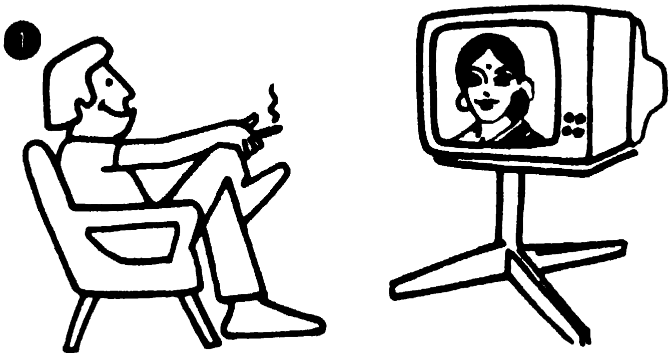

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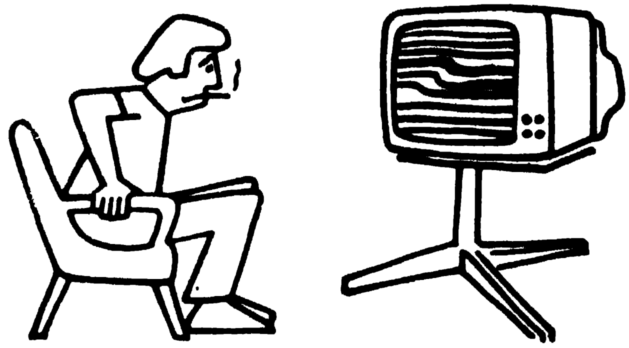

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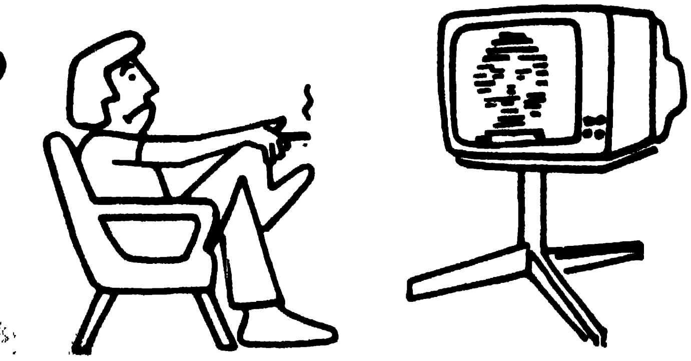

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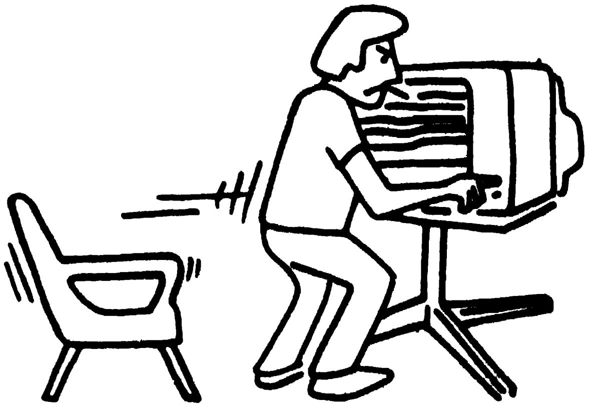

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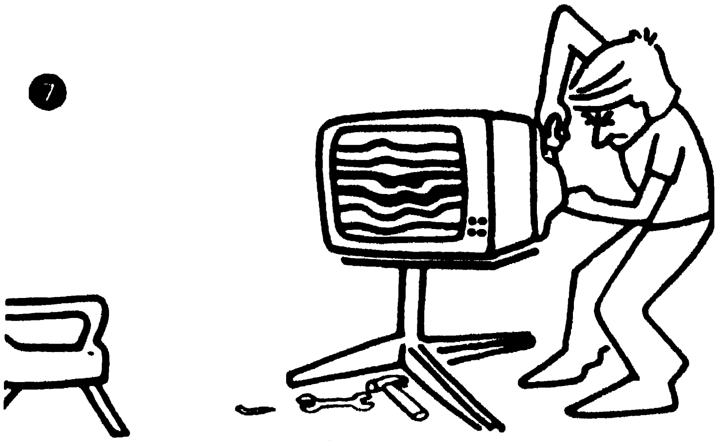

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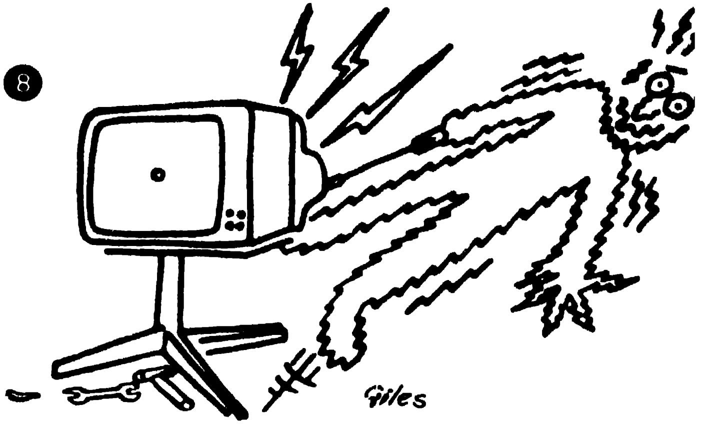

the outlet, reverse the plug. If the plug fails to make proper fit and contact, consult your electrician. Do not defeat the safety purpose of the polarised plug.

10. Alternative warnings: In the television receiver equipped with a three-wire grounding type plug (a plug having a third grounding pin), the plug will only fit into a grounding type power outlet. This is also a safety feature. If you are unable to insert the plug into the outlet, contact your electrician to replace the obsolete outlet. Do not defeat the safety purpose of the grounding type plug.

11. Do not allow anything to rest on the power cord. Do not locate the television receiver where the cord will be abused by persons walking on it.

12. Follow all warnings and instructions marked on the television receiver.

13. If an outside antenna is connected to the television receiver, be sure that the antenna system is grounded so as to provide some protection against voltage surges and built-up static charges. The installation must be carried out by qualified technicians utilising accessories recommended by the manufacturer.

14. For added protection of the television receiver during a lightning storm or when it is left unattended or unused for long period, unplug it from wall outlet and disconnect the antenna. This will prevent damage to the television receiver due to lightning and power line surges.

15. An outside antenna system should not be located in the vicinity of overhead power lines where it can fall into such power lines or circuits. When installing an outside antenna system extreme care should be taken to keep from touching such power lines or circuits as contact with them might be fatal.

16. Do not overload wall outlets and extension cords as this can result in fire or electric shock.

17. Never push objects of any kind into the television receiver through the cabinet slots as they may touch dangerous voltage points or short circuit parts that could result in a fire or electric shock. Never spill liquid of any kind on the television receiver.

18. Do not attempt to service the television receiver yourself as opening or removing covers may expose you to dangerous voltage or other hazards. Refer all servicing to qualified service personnel.

19. Unplug the television receiver from the wall outlet and refer servicing to the qualified service personnel under the following conditions:

(a) When the power cord or plug is damaged.

(b) If liquid has been spilled into the television receiver.

(c) If the television receiver has been exposed to rain or water.

(d) If the television receiver does not operate normally by following operating instructions. Adjust only those controls that are covered by the operation instructions. An improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the receiver to normal operation.

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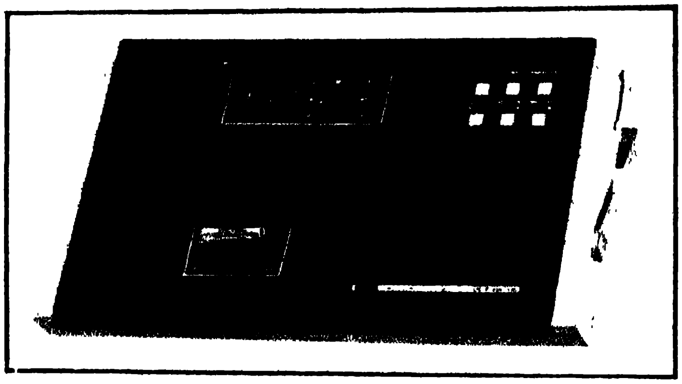

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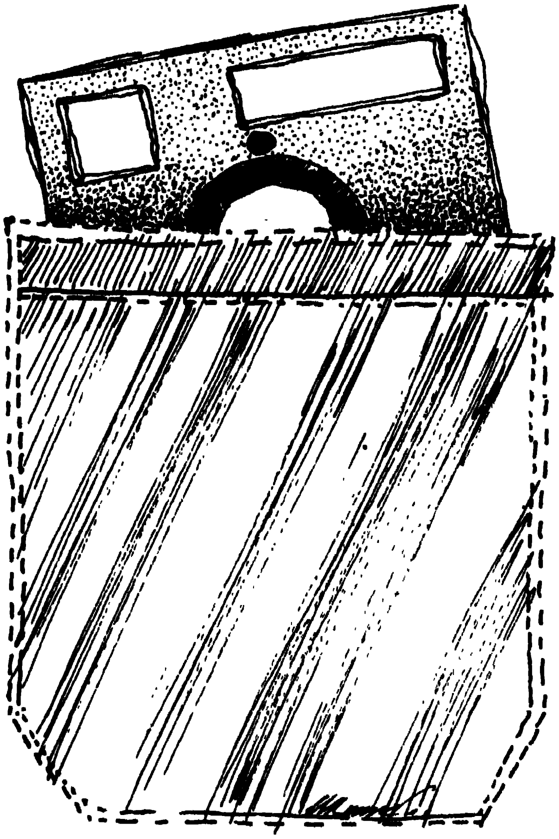

Microfloppies: A Landmark

Vasudeo P. Behere

The data storage media industry comprising more than thirty reputed computer manufacturers all over the world has recently announced the introduction of a new microfloppy drive in the market having a size of 8.9cm (3.5-inch). The drive has replaced the existing (Osborne fame) 13.34cm mini (5.25-inch) drive.

The announcement of this new version came as a surprise to everybody as many other sizes of the drives were also being declared by other manufacturers. The announcement of this 8.9cm drive with far better features created a new war for market acceptance among others. This new floppy drive was smaller, cheaper and lighter compared to the existing drives.

The reduction of size and weight of the drive was a welcome measure for making the computer system more compact and rugged, as drive constitutes sixty per cent of the volume and weight of the computer system. The new drive was also consuming 50 per cent less power than the existing drives. Thus, the rating of the power supply were also brought down by this drive which would consume only 8 watts of power instead of 25 watts consumed by the earlier drives.

The third important feature was the storage capacity, which remained unaffected though the size was reduced. Thus, it could still store about 1 megabyte of information on double side double density (DSDD) version. The drive had other interesting features like hard shell cartridge and an automatic shutter which could offer greater protection and ensure smooth and trouble-free operation.

The announcement of this drive was made when the other three drives, ranging in size from 7.5 cm to 9 cm, were competing among themselves. Each of the above drive was supported by at least one big name in the market and thus the race for market capturing was triggered on.

The 7.5cm drive was introduced by such Japanese big-shots as Hitachi and Matsushita, and was of the smallest size among the others, but it had reliability constraints due to very high track density (80 tracks per cm). The 8.2cm drive announced by companies like Dysan, Seagate, Soroc and Tabour was the most inexpensive drive and used soft-jacket in place of hard-shell cartridge, sacrificing its reliability. The computer giant IBM had by that time announced another 10 cm drive, but this drive had higher access time and lower storing capacity than others.

Compared to all other drives, the 8.9cm drive had improved version of media and head positioning technology. The access time was also low as drive motor was made to rotate at 300 RPM instead of 600 RPM, allowing transfer of 500 kilobytes of information per second. It also made use of brushless DC motors, providing quiet and smooth operation.

The 8.9cm drive was then brought out for sale by data storage media industry consisting of Tandon, Control Data Corp., Fuji, Sony, Hewlett Packard, etc at the end of 1983 and rapidly it reached record sale. The 1984 started with 8.9cm drive in almost all personal computer systems, office equipments, scientific and engineering instruments, memory typewriters etc, and thus the war ended in favour of the 8.9 cm drive due to its superiority in qualities and greater compatibility over other drives. The victory was clear when IBM discarded its 10cm drive so as to use the 8.9cm drive in its personal computers.

Though this storm is over, the war will continue on other fronts for creating new standards in the market. Such races only have brought us this gift of computers by way of an electronic revolution. The race has also reduced the size of computer from the size of a room from ENIAC days to the modern desk-top computer. This race has brought these computers within the reach of an ordinary man, though earlier these could be used only by highly trained teams of scientists and engineers. The same race has brought down the prices of these machines so that with the help of better techniques of fabrication and mass production, they are now within the reach of an ordinary man.

All aspects of computer systems like data-processing, data storage, printing output etc are constantly being looked into for possible development. The Winchester disc drive is another such field which is gaining more respectability among the computer users. The development of new Winchester drives with greater storage capacity, but of smaller size, is now under such competition and IBM is expected to come out with a new model of Winchester as it also holds another hard-disc giant, namely, Tandon, under its wing. □

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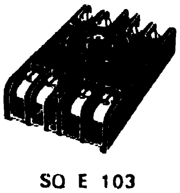
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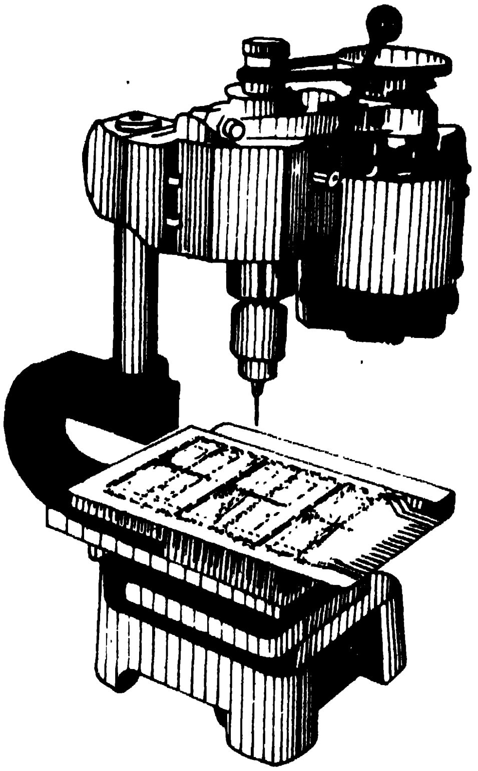

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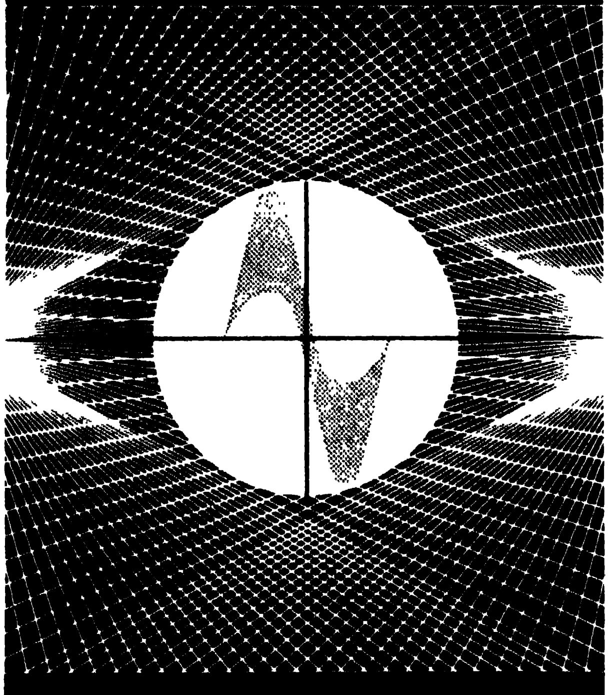

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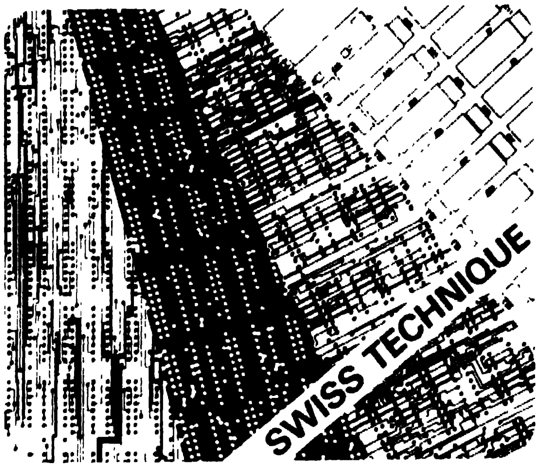

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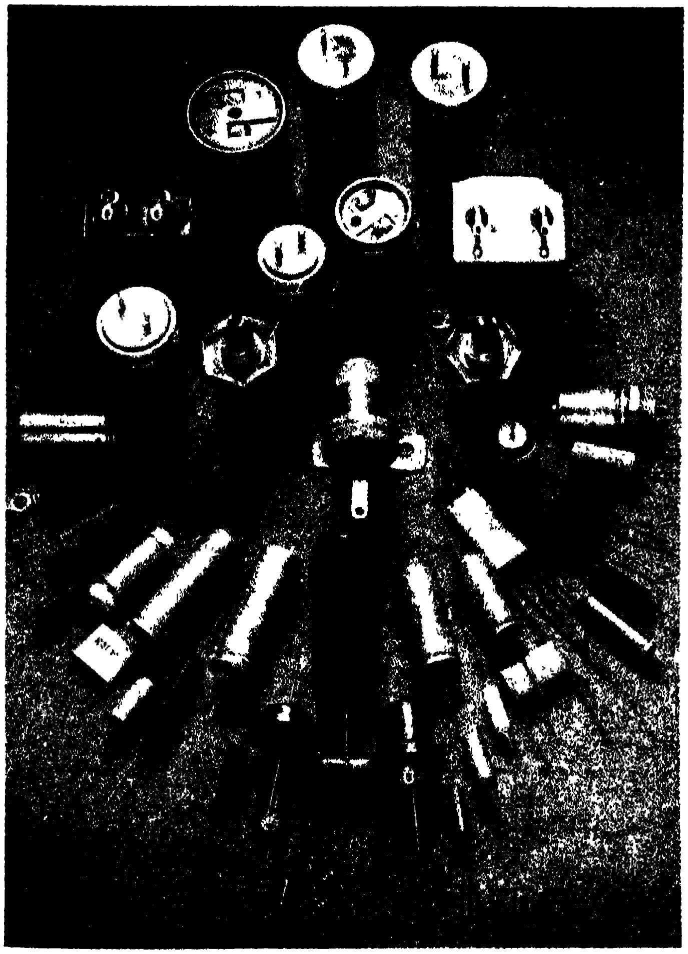
Part II—Varieties

D. Venkatasubbiah



Capacitors may be classified based on the physical state of their dielectric. The dielectric may be either a gas (or vacuum), a liquid, a solid, or a combination of these. They may be further subdivided according to the specific dielectric used.

Capacitors are also classified as: fixed, adjustable, variable and trimmer.

Fixed capacitors. All single pieces of discrete capacitor components are included in this group. Their capacitance remains fixed and unchanged except for small variations caused by temperature etc.

Adjustable capacitors. The capacitance of these may be set in steps at any one of the several discrete values.

Variable capacitors. Their capacitance may be adjusted continuously and set at any value between the minimum and maximum limits fixed by its construction.

Trimmer capacitors. These are relatively small variable capacitors, used in parallel with large variable capacitors or fixed capacitors so as to permit exact adjustment of the capacitance in parallel combinations.

Capacitance range

Typical capacitance range of different types of capacitors is as given below:

Air	up to about 1000 pF
Gas	
Vacuum	
Mica	few pF to few thousand pF
Glass	
Low-k ceramics	
High-k ceramics:	a few hundred pF to a few μF
Paper:	Tens of pF to tens of μF
Plastic film:	Thousand pF to hundred μF
Electrolytic:	1 μF to 1 farad

Air/gas/vacuum capacitors

These are constructed with flat parallel metallic plates or cylindrical concentric plates with air, gas or vacuum as dielectric. Alternate plates are connected together (as shown in Fig. 3) and are supported by means of a solid insulating material such as glass, quartz, ceramic or plastic.

Gas capacitors are enclosed in a leak-proof case while vacuum capacitors are sealed in highly evacuated glass envelopes. Vacuum or gas under pressure increases the voltage breakdown value for a given plate spacing. Therefore gas and vacuum capacitors are used in high voltage circuits such as transmitters.

Air capacitors are used in high voltage or/and high frequency circuits. They are mainly used as variable capacitors in sizes up to about 1000 pF. They are commonly employed in radio receivers etc for frequency tuning. The shape of electrodes determines whether the angle of rotation gives linear change of capacitance or tuned frequency. Miniature air trimmers are used in RF, VHF and microwave applications, frequency tuning, impedance trimming, etc. Tiny giga hertz trimmers are also available, which provide a beautifully straightforward technique to fine tune RF hybrid and microwave circuits into proper behaviour. Air capacitors provide high Q and low losses. Both fixed and variable capacitors of special design are used as laboratory standards also.

Liquid dielectric capacitors

The plate assemblies of these capacitors are mounted in a tank filled with a suitable oil or liquid dielectric. External connections are made with insulators or bushing.

Dielectric constant of liquid dielectric ranges from 1.5 to 100. In non-polar liquids, whose dielectric constant is substantially independent of frequency, it ranges from about two to five. It is possible to increase capacitance by filling the plate space with a non-polar liquid such as mineral oil, which gives low losses at high frequencies.

The dielectric constant of mineral oil is 2.2, that of castor oil is 4.7 and of silicone oil is 2.6. It is essential to ensure that oils used for this purpose are carefully purified, clean and free from moisture. Silicone oils have a wider range of operational temperature and much higher flash point. Provision has to be made for the expansion and contraction of the liquid during temperature changes.

Oil-filled capacitors are generally used for high voltage applications like transmitter capacitors. Transmitter capacitors have to operate at several kilovolts. They must work at high voltages, high powers and high frequencies. For example, broadcasting transmitters have several hundred kilowatts of power. The main problems in such applications are those of spark-over, adequate spacing of vanes consistent with resonable size and losses at high frequencies due to insulation. Appreciable rise in temperature of insulation occurs due to dielectric heating. Generally four main types of transmitter capacitors are used - air-filled, pressurised or gas-filled, vacuum and oil-filled. Oil-filled types give high capacitance in a smaller package.

The main disadvantage of liquid-filled capacitors is that they cannot be kept in any position other than upright, which is most inconvenient in general usage.

Solid dielectric capacitors

These capacitors use solid dielectrics such as paper, mica, glass, quartz, ceramic, plastic films etc. Alternate plates of metal or metallic foil are stacked with the dielectric layer.

So far only the oldest forms of capacitors — air- and oil-filled capacitors have been discussed. Air capacitors are available for low values only, as due to unity dielectric constant, realising higher values is not possible. Therefore, they are essentially high frequency components. Although oil-filled capacitors are smaller than air capacitors, they are not very convenient for general purpose. They are specialised capacitors for high voltage application. It remains for the solid dielectric capacitors to serve as the general purpose circuit components.

Since there were very few solid type capacitors in the earlier times, the choice between them was comparatively easy. In fact, there were only three basic types—electrolytic, paper and mica. Electrolytic types offered large and cheap capacitors with comparatively poorer electrical characteristics. They were used for power supply filtering, and other low frequency applications. Caution of proper DC voltage polarity should be taken.

Mica capacitors were the most superior capacitors, used for high frequency and high quality circuits. The main problem of mica was that only small values of it was available.

The middle ground was taken by the impregnated paper capacitors which combined the good characteristics of both mica and electrolytic types to make it suitable for more varied usages in electrical circuits than any other type. Paper capacitors were the cheapest and most popular as well as most widely used AC capacitors. The superior mica capacitor was used only when the paper capacitor was not found satisfactory.

At present, the things are altogether quite different and complex, with many additional varieties of capacitors. The electrolytic capacitors are still used but improvements have been done by way of dry electrolytics, introduction of solid types, miniaturisation etc. The popular paper capacitors have been mostly replaced by film capacitors. Polyester capacitor has become the commonly used AC capacitor. Ceramic and polystyrene types are taking the place of mica even though it possesses unsurpassed qualities. Ceramics are inexpensive and ideal for printed circuits and are widely used in RF applications in general. Polystyrene capacitors are precision capacitors.

Fig. 3: Multiplate capacitor.

Paper capacitors

Paper capacitors are one of the oldest types. The first paper capacitor came into existence in 1876. Paper is the cheapest dielectric, therefore it yields the lowest cost capacitor. Saturation of paper with insulating oils increases its insulation resistance, temperature range and primarily its working voltage, since oil fills the air gaps which would otherwise produce corona Such impregnated paper is used as a dielectric, with a dielectric constant of about three to five.

Although paper is cheap, it has the disadvantage of having a low dielectric strength. Usually two or more layers of paper are used. The probability of a point of weakness in one layer coinciding with another in the second layer is extremely small. With three layers one can count on having the strength of at least two layers.

Paper capacitors are usually constructed in the form of a roll, where bands of metal foil and the dielectric are rolled up

until there is sufficient capacitance. The roll is then impregnated and may be mounted in an imperious case. The impregnation is for sealing as a protection against moisture. Otherwise, the hygroscopic paper can alter both the capacitance and the insulation with dampness and temperature.

Metallised paper capacitors

Metallised paper capacitors are an improved version of the normal paper capacitors, which appeared at the end of the 1940s. They differ from the paper capacitors only in that the conducting coating is formed by metallising directly on the paper. Thus, while the electrical properties are maintained, a considerable reduction in size is gained. Furthermore, a valuable new quality of 'self-healing' is acquired. The electric arc which arises with breakdown, evaporates the metal layer in the affected region, without impairing the dielectric. The breakdown ceases immediately, since the metal around the point of breakdown is burnt away. This interesting property made it possible to use a single layer of paper as dielectric. By applying a voltage twice the operating voltage after manufacture, critical points of weakness can be burnt away and paper's own dielectric strength can be better exploited. The capacitance decrease caused by the self-healing process is of a small proportion only.

> **Mica is a natural inorganic material which is mechanically extremely robust. Mica has excellent qualities as a dielectric, namely, a high dielectric constant, low losses, high dielectric strength and very good stability.**

Paper capacitors have low cost per unit capacitance and moderate capacitance-to-volume ratio. They have a good insulation resistance, fairly good stability and a capacity of operating up to a temperature of 125°C. They are useful over a frequency range of up to 10MHz or more. Paper capacitors were the only general purpose AC capacitors in use before the advent of plastic film capacitors. The nominal paper capacitor values are from tens of pF to tens of μF. A good capacitor can age up to two per cent of the original capacitance.

The life of paper capacitors depends on the working voltage and temperature. Thus the maximum permissible DC working voltage is dependent on the ambient temperature. The maximum voltage which may be applied instantaneously without destroying the capacitor is termed as the spark voltage. Maximum voltage should never be applied for more than a few seconds, as continuous sparking tends to destroy the capacitor.

Mica capacitors

Mica capacitors are also one of the oldest types. The first mica capacitor was made in 1845. In these thin sheets of high grade mica are used as dielectric with a dielectric constant in the range of six to eight. Various types of mica capacitors are as below:

Stack-foil mica capacitors. Consist of alternate layers of metal foils or deposited metal films and sheet-mica insulators which are stacked, compressed and then encapsulated.

Silvered mica capacitor. Has a silver electrode material screened on the mica stampings which are then assembled and encapsulated. Nowadays silvered mica capacitors are more common. Their capacitance value is varied by the number of stacked plates. Further alteration of the capacitance can occur by scraping away the silver layer.

Mica is a natural inorganic material which is mechanically extremely robust. Mica has excellent qualities as a dielectric, namely, a high dielectric constant, low losses, high dielectric strength and very good stability. Therefore, mica capacitors have inherent characteristics of high insulation resistance, low inductance, excellent stability, low dielectric losses even at high frequencies, good temperature, frequency and aging characteristics. These unique qualities make them well suited for high frequency applications and high quality circuits. Their temperature coefficient is low, lying between 0 and 70 ppm per°C. They can be manufactured with good tolerance of about one per cent in normal production. Even a closer tolerance of down to±0.1 per cent is not difficult. They are made with DC voltage ratings from a few hundred volts to several thousand volts. Their wide temperature extends up to 125°C and insulation resistance is many thousands megohms. Silvered mica capacitors are available in moulded type, dip-coated type or wax-coated type in our country.

Fig. 4: Disc ceramic capacitor.

Since they have a low capacitance-to-volume or mass ratio, they are suitable for circuits requiring low values and good stability with respect to temperature, frequency and aging. Their disadvantge is that they are bulky and expensive.

Ceramic capacitors

Ceramic capacitors come in a variety of sizes, shapes and ratings. They are the most popular of all capacitors due to their outstanding versatility. The dielectric of the ceramic capacitors is a mixture of titanium oxide with other titanates. The dielectric constant varies extremely widely, from about six to 10,000 or even more, depending on the composition of the ceramic mixture. Ceramic capacitors have a very high capacitance-to-volume or mass ratio. Their distinct merits over other capacitors are their suitability for use in printed wiring boards, reliability and small size.

The stability of the dielectric constant with respect to temperature is an important feature. In general, the stability of the capacitance value with temperature variations depends on the low dielectric constant (k).

High-k or low-k

Ceramic capacitors are usually divided into low-k or class I ceramics and high-k or class II ceramics. High-k capacitors usually have a dielectric constant of more than 3000. They are extremely small sized for any given capacitance value and voltage rating. They are used mainly for bypass and coupling, and are usually in the range from 0.001μF to several μF. These are chiefly used for non-precision applications where appreciable capacitance change is tolerable. Typical non-critical applications are bypass, coupling, filtering etc. Their capacitance varies with temperature, electric field intensity, applied frequency and self-aging.

For greater stability with temperature, semi-stable and temperature-stable, low-k capacitors are used. They exhibit a capacitance change of about five to 15 per cent. Temperature compensating capacitors exhibit controlled and predictable variations in capacitance with change of temperature. They have dielectric constant in the range of six to 200, signifying a larger capacitor size for a given value. They have high Q, which is required for critical circuit functions, such as in oscillator and filter circuits. They have linear TCC (temperature coefficient of capacitor) and high stability with low losses.

The disc and plate types are ideal for printed circuit wiring and need minimum space. The hard inflexible tube of the tubular type acts as a support for the electrodes and leads, in addition to providing dielectric. The tubular form lends itself to efficient space utilisation.

NP0 capacitors

Special ceramic capacitors that remain stable with temperature are called negative-positive-zero (NP0) capacitors. They are even more stable than the silvered mica capacitors. They are used in many kinds of receivers. Their values are between 1 pF and several thousand pF.

The temperature coefficient of temperature compensated ceramic capacitors is denoted by a number prefixed by letter P or N, for example, P100, N150, N750 and so on. A commonly used temperature coefficient is N750. Capacitors with this temperature coefficient have a k of about 90. N750 means that the decrease in capacitance will be 750 parts per million or 750 ppm per°C of temperature rise. In other words, the capacitance decreases by 0.075 per cent for 1°C increase or 1.5 per cent for a 20°C increase. Thus, the prefix N means negative temperature coefficient of capacitor or negative TCC. Similarly, P means positive TCC.

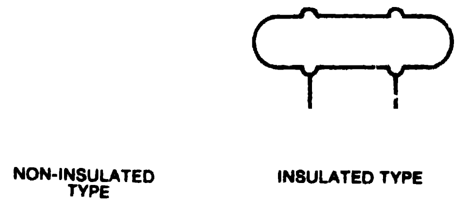


Fig. 5: Tubular ceramic capacitor.

Construction type ceramic capacitors

Several construction type capacitors are also currently in use—disc, tubular, plate, ceramic barrier layer, feed-through, stand-offs, multilayer chips, mono-block, monolithic and so on.

Their electrodes usually consist of silver or some other good electrical conductor. For multilayer capacitors palladium or platinum is used, since the electrodes are applied before the ceramic is fired at a temperature at which silver would oxidise.

The raw materials are finely grinded and carefully mixed. After calcining, the resultant mass is reground and then mixed with, for instance, water and binding matter. The various shapes are obtained by extruding or rolling. After drying, the capacitor bodies are fired at high temperatures. Normally, the leads are soldered to the electrodes of the capacitor body with a high melting-point solder.

Disc capacitors. Consist of a ceramic disc with both sides metallised and provided with connecting leads (Fig. 4).

Tubular capacitors. Consist of a ceramic tube fully metallised internally and partially outside with two tangential leads. Both insulated and non-insulated tubular versions are available (as shown in Fig. 5).

Miniature ceramic plate capacitor. Consists of a thin rectangular ceramic plate, metallised on both sides and provided with leads (Fig. 6).

The disc and plate types are ideal for printed circuit wiring and need minimum space. The hard inflexible tube of the tubular type acts as a support for the electrodes and leads, in addition to providing dielectric. The tubular form lends itself to efficient space utilisation. An incidental advantge of this space is that it automatically provides separation between the leads, a valuable feature in high voltage usages.

Component package

Since the materials are comparatively non-hygroscopic, a complete coating of lacquer is usually sufficient for protection. The ceramic types do not always require the elaborate mounting or potting which are often so essential with other capacitors. Some ceramics rival mica in stability and loss and also have the added advantage that they can be moulded into a variety of useful shapes. Ceramic capacitors are available for use from kilohertz range to many megahertz range. Special types which work through gigahertz range are also available.

Ceramic trimmers are widely used from audio to 500 MHz. They provide an ideal low cost means of trimming circuits, such as crystal oscillators, RF amplifiers, all varieties of communication and test equipment. They are much smaller than air trimmers.

Ceramic and mica compete with each other.

Mica versus ceramic

Some manufacturers claim superiority of multilayer ceramics over mica. Mica manufacturers disagree. Modern mica capacitors are well developed. The initial tolerance, long term stability, high temperature operation, high-frequency performance, low losses—all seem to favour mica. Yet let us compare them:

Tolerance. Mica capacitors are manufactured with excellent tolerance of 0.1 per cent while ceramic types are much worse-off. A capacitor of 4765.5 pF can be made easily in mica but not in ceramics.

Stability. Mica capacitors are available with a 10 year stability of 0.1 per cent, which is not possible with the best ceramic ones in the world.

Performance. Ceramics rely on mixtures of oxides of rare earths. The manufacturers must not only struggle to maintain the purity of individual materials, but must vary the mixture to meet economic pressures. Changes in the mixtures may not affect the characteristics of the device at 250°C and at 1kHz test frequency, but it does effect at higher frequencies.

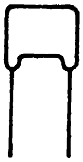


Fig. 6: Miniature ceramic plate type capacitor.

In contrast, mica capacitors retain good characteristics in the GHz range also. Often mica capacitors submitted for calibration caused the measuring bridge to show a negative power factor. It is a feature worth patenting! The fact is that the mica devices are of better quality than those used as standards in even the bridge.

High temperature. Devices are currently available for use of mica at 300°C. If larger values are required at high temperatures (125°C), mica can be fabricated into a paper and wound into larger units. These reconstituted mica capacitors are almost indestructible and find use in defence and aerospace projects. Temperature holds no danger for mica, since it existed even 4 million years ago, but it is not so for ceramics.

High voltage. Mica requires no voltage derating to 125°C, works at voltages over 60kV and has also survived the 100,000 g shock.

All the above points are quoted only to indicate the superior quality of mica capacitors. It also clearly establishes that the ceramics are definitely competing with mica because they compare favourably. Ceramic capacitors are inexpensive, smaller in size and a variety of types are available to meet every need in general. They are specially used in radio frequency circuits more than any other capacitor type.

Glass capacitors

Glass is used as dielectric in such capacitors. The dielectric constant of glass varies from four to 6.8, depending on the type of glass.

Glass capacitors consist of glass plates stacked in layers as dielectric, with metal foils as electrodes. Glass and metal are melted to a block at high temperature. The use of the same kind of glass for both the dielectric and the casing makes it feasible to create monolithic sealed capacitor.

The inorganic glass has a very good resistance against atomic and cosmic-ray radiation. Glass capacitors have high Q and low losses at radio frequencies, small and positive TCC, close tolerance of about one per cent, very high insulation figure, typically one million ohm farad, and are suitable for high voltage and high temperature operation. They are quite stable over wide temperatures and are protected against moisture. They can work with AC peak voltages equal to rated voltages even at the maximum temperature of 125°C.

The glass capacitors are used in RF and IF circuits. They are suitable for use as measuring and resonant circuit capacitors. The capacitance values are low, say, from about one pF to few thousand pF. They can resist aging, moisture, shock, vibration and can function under extremes of temperature. Glass trimmers are also used in high frequency circuits.

Quartz capacitors

Dielectric constant of quartz is 3.8. Quartz capacitors are also high quality RF capacitors like glass capacitors. Quartz trimmers are especially used in RF applications. They are unique in the fact that they can carry high RF current in amperes and withstand high RF voltages. Their quality factor is higher than that of the glass types.

Plastic/film capacitors

Plastic or film capacitors is a collective name for several types of capacitors with different materials as dielectric. They are truly symmetrical or non-polar capacitors, well suited for AC application. Polymer films are available in thinner gauges and thus have higher capacitance density compared to glass or mica but lower than the electrolytics. These capacitors are dry, non-polar, show low loss, have excellent insulation resistance and low moisture absorption.

Polystyrene was the first plastic used in capacitors during the thirties. However, various types of material later came into use. The popular ones are polyester, polystyrene, polycarbonate and polytetra fuloro ethylene (PTFE).

Chemical name	Dielectric constant	Commercial name or trade name
Polyester	3.3	Mylar, Melinex
Polystyrene	2.5	Styroflex, Styrofoil
Polycarbonate	3.2	Makrofol
PTFE	2.1	Teflon

Plastic capacitors are manufactured in a similar way as paper capacitors, with plastic foils replacing the paper. They consist of alternate layers of metal foil and one or more layers of flexible plastic insulating material in ribbon form rolled up together and encapsulated. The metal foil is either aluminium or tin ribbon in foil-type capacitors, or a thin vapourised layer of metal deposited on the surface of the insulating materials in metallised dielectrics.

Metallised dielectrics

Metallised dielectrics are more popular. Through an evaporative process, a metal layer is deposited on a dielectric surface to form the metallised dielectric. The metal deposition then replaces the conventional metal foil conductive plate used in a standard film-foil capacitor.

Exhibiting the same basic electrical characteristics as the film-foil capacitors, the metallised series offer advantages in size and weight savings and have 'self-healing' properties, which prevent momentary voltage surges from effecting permanent capacitor breakdown. The breakdown ceases immediately because the metal burns away around the point of breakdown and a metal-free zone is built up. These advantages, coupled with only a slight increase in cost, are taking the metallised dielectrics towards dominance in the wound capacitor field.

After winding, such capacitor rolls are heat treated. This 'baking' causes the stretched plastic foils to shrink, thus sealing the capacitor and providing protection from moisture, without becoming a sealed construction. This also ensures that the roll becomes compact, and dimensionally stable. This capacitor roll can be used up to 70°C as the absorption of dampness is insignificant here. If sealed, the capacitor can be used at higher temperatures too.

These capacitors have very high insulation resistance quality. They absorb an insignificant amount of dampness and are thus comparable to mica and superior to paper. With regard to losses and stability, polystyrene and teflon are comparable to mica, while polyester and polycarbonate are more comparable to paper. Polystyrene, polycarbonate and teflon capacitors have excellent TCC characteristics. Their capacitances range from about 0.001 μF to 100 μF.

Polyester capacitors

Polyester capacitors are the most popular and inexpensive among plastic capacitors. Their only drawback is the high TCC. They are characterised by high dilectric strength and are suitable for operating temperatures up to 150°C. They have been in use since many years and have largely replaced paper as the standard capacitor dielectric for electronic applications. Polyester also allows for many special designs and applications. They can be used up to voltages of 1000 V. Their typical insulation resistance is greater than 50,000 megohms

Polystyrene capacitors

Polystyrene is a thermoplastic material with a melting point of just over 90°C. Thus, polystyrene capacitors have a maximum temperature rating of only 85°C.

They are characterised by extraordinarily low dielectric absorption and very high insulation resistance with an excellent low and linear negative TCC. This film yields relatively high capacitance density due to thinner guages.

Due to low dielectric absorption, low losses and constant negative TCC, this capacitor is particularly suitable for use as resonant circuit capacitor where ferrite coils with a corresponding positive TCC are used so that the resonant frequency can be kept constant and independent of temperature variations. Therefore, polystyrene capacitors are widely used in filter networks and as precision capacitors. They are ideally suited for computers, timing applications as well as tuned circuits and can work from audio to radio frequencies in a very high frequency range. **(To be continued)**

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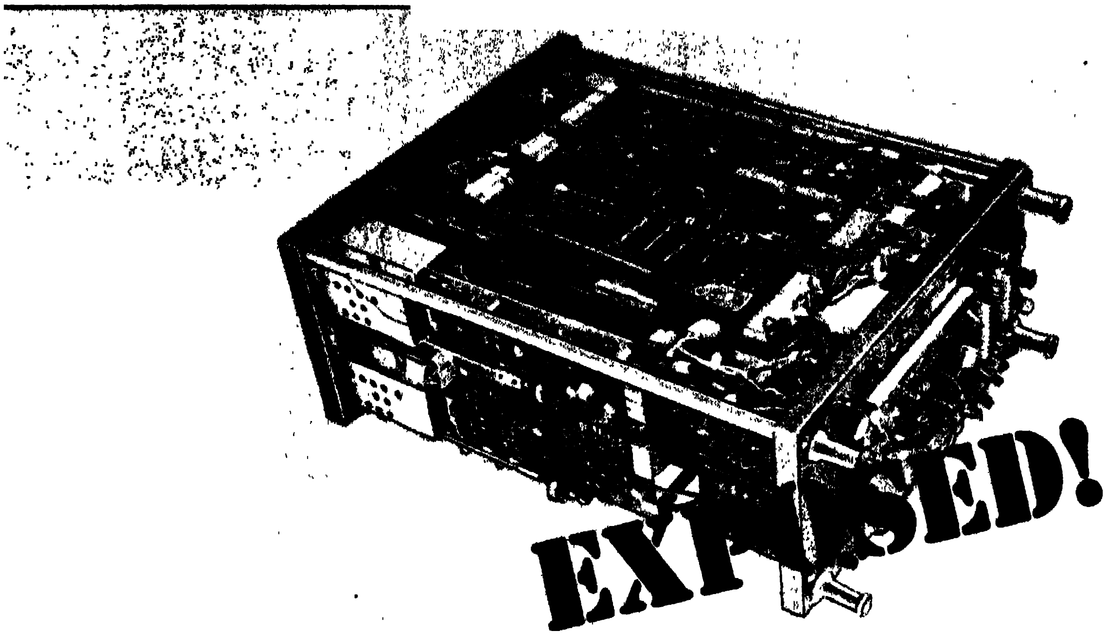

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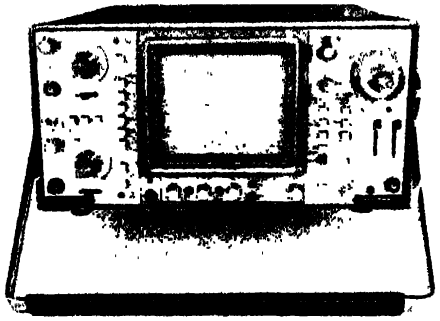

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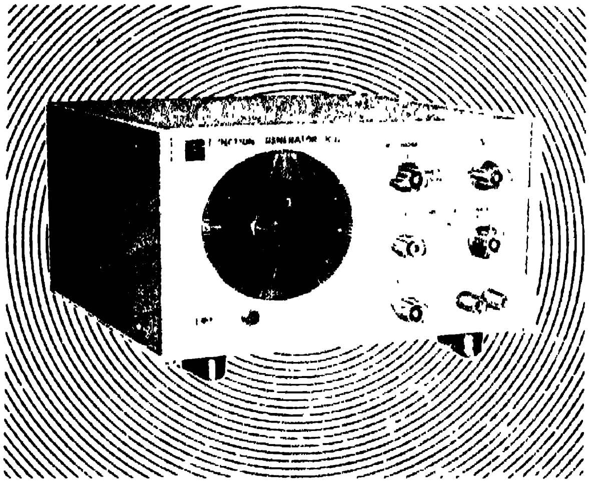

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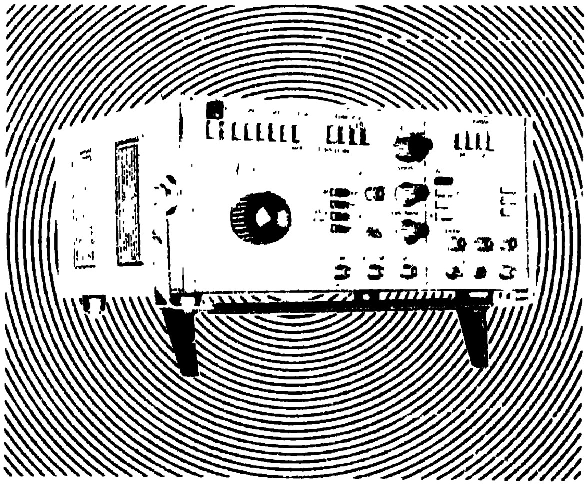

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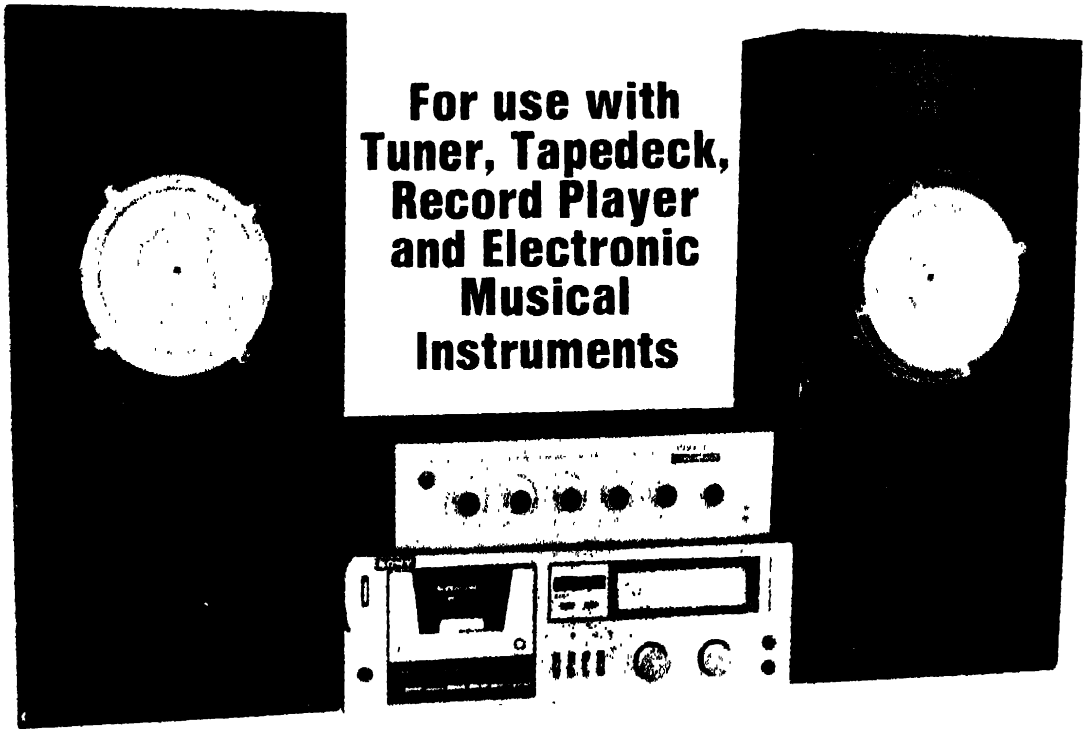


For use with Tuner, Tapedeck, Record Player and Electronic Musical Instruments

A stereo system is probably one of the most popular projects for an electronic hobbyist and the professional alike. The one described here costs less than a thousand rupees, including the speaker system.

The stereo amplifier is built around integrated circuits only and does not employ any discrete transistor. 741 op-amps are used in the preamplifier and active tone control. The power amplifier section is built around a TDA 2020. The use of integrated circuits, especially in the power amplifier stage, greatly simplifies construction.

The TDA 202C integrated circuit features internal protections. No damage occurs if the output circuit is shorted. Since it also incorporates thermal protection, there is no danger of thermal runaway if excess power is dissipated in relation to the heatsinking used. High temperatures cause the IC to shut-down, but normal working is restored when

SPECIFICATIONS

SENSITIVITY

Input A	5 mV	(47k impedance)
Input B.	50 mV	(500k impedance)
Input C	150 mV	(1.5M impedance)

POWER OUTPUT

With ±17V and 4-ohm speaker 20W
With ±17V and 8-ohm speaker 13.5W

TOTAL HARMONIC DISTORTION

At 20W Less than 1%
At 8W: Less than 0.2%

FREQUENCY RESPONSE

20 Hz to 20 kHz (-3dB)

TONE CONTROLS

Bass: +9dB to -12dB at 100Hz
Treble +12dB to -20dB at 10 kHz

(Note: Good soldering is the most important thing for a successful project. Dry joints can give rise to nasty problems, especially if they occur in high current areas in the power output stage.)

the temperature has fallen. Both the channels are powered with the same dual power supply of ±17V.

The complete circuit diagram of the stereo amplifier (only one channel shown, the other being similar) is shown in Fig. 1.

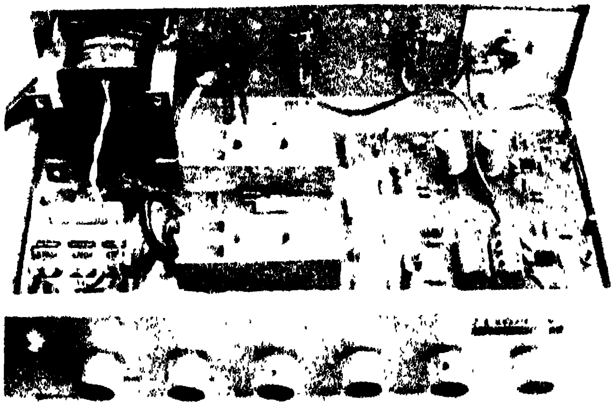
Preamplifier

Input to the preamplifier is via DC blocking capacitor C1. Resistor chain comprising R1, R2 and R3 forms an attenuator. The voltage across R3 is applied to IC1 input. The values of these resistors have been calculated such that the sensitivity is 5 mV in position A, 50 mV in position B, and 150 mV in position C. Values of R1 and R2 can be altered to suit individual requirement of input of sensitivity. The gain of the first stage is approximately fifty. (The preamp does not provide any kind of equilisation. So tape head/magnetic phono inputs should be passed through suitable equalisers before feeding to this amplifier.)

Tone control

Preamp output at pin 6 of IC1 is fed to tone control circuitry via C2. The tone control being 'active' type, gives both boost and cut of treble and bass.

The circuit has almost unity gain throughout the audio range when bass and treble are set to their mid-way positions. The gain for a frequency of 1 kHz is unity at all settings of the tone controls. All other frequencies are boosted or cut as the controls are rotated.



— An inside view of the author's prototype.

The performance of the tone control is tabulated below:

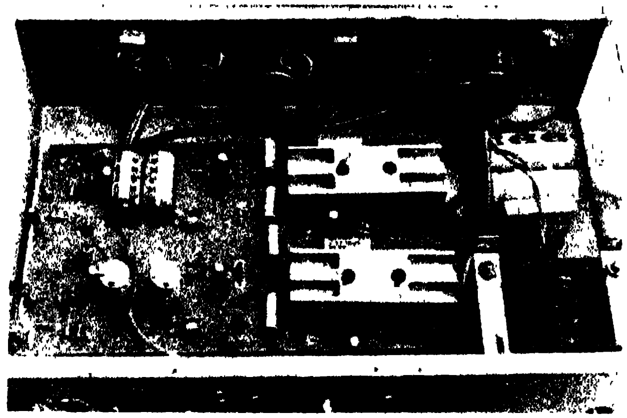
Frequency	Max. Cut	Max. Boost
Bass (at 100Hz)	-12dB	+9dB
Treble (at 10kHz)	-20dB	+12dB

Output of the tone control is fed to volume control VR3 through C5. The signal level across VR3 will be around 240 mV for an input voltage of 5 mV across R3. There is no need for a balance control since each channel has separate volume control.

Power amplifier

From VR3 coupling is by C6 to the input pin 7 of IC3. Negative feedback from the output (pin 14) to the inverting input (pin 8) is set by R14, R15 and C10. The presence of C10 offers unity feedback at DC so as to keep output offset to a very small value. This enables direct coupling of the speakers to the output. R14 and C10 dictate the low-frequency roll-off characteristics. C9 is a frequency compensation capacitor. C13 and C14 are HF decoupling capacitors fitted very close to the pins of IC3.

The maximum supply for TDA 2020 is ±20V. But this is not recommended as the IC may be damaged if higher voltage should arise, and the power output obtained is not a great deal more with a more than ±17 volts supply. With 4-ohm speaker and ±17V supply, power output obtained is 20 watts. With 8-ohm speaker and ±17V supply, the output will be reduced to 13.5 watts.



— Another view of author's prototype.

Construction

The full-size printed circuit board layout for one channel is shown in Fig. 2. The same layout can be used for making a combined PCB for both the channels, which will have a size of 22cm by 13cm. All components, except power supply and volume, treble and bass control pots, are soldered into the PCB.

It is preferable to assemble the low-profile components—such as resistors, diodes and small capacitors—first, followed by ICs. Take care to see that all polarised components—such as diodes, electrolytic capacitors and integrated circuits—are mounted with correct orientation.

Before installing IC3, holes should be drilled in the PCB to suit the heatsink used. In the prototype a solid aluminium heatsink of 8.5cm length, 3cm width and 2.2cm height was used. It is important to note that C9 and a few resistors lie under the heatsink. Care should be taken to ensure that excepting the IC no component makes contact with the heatsink.

The heatsink mounting nut and bolt should be well isolated from the PCB foil. In any case it should not make

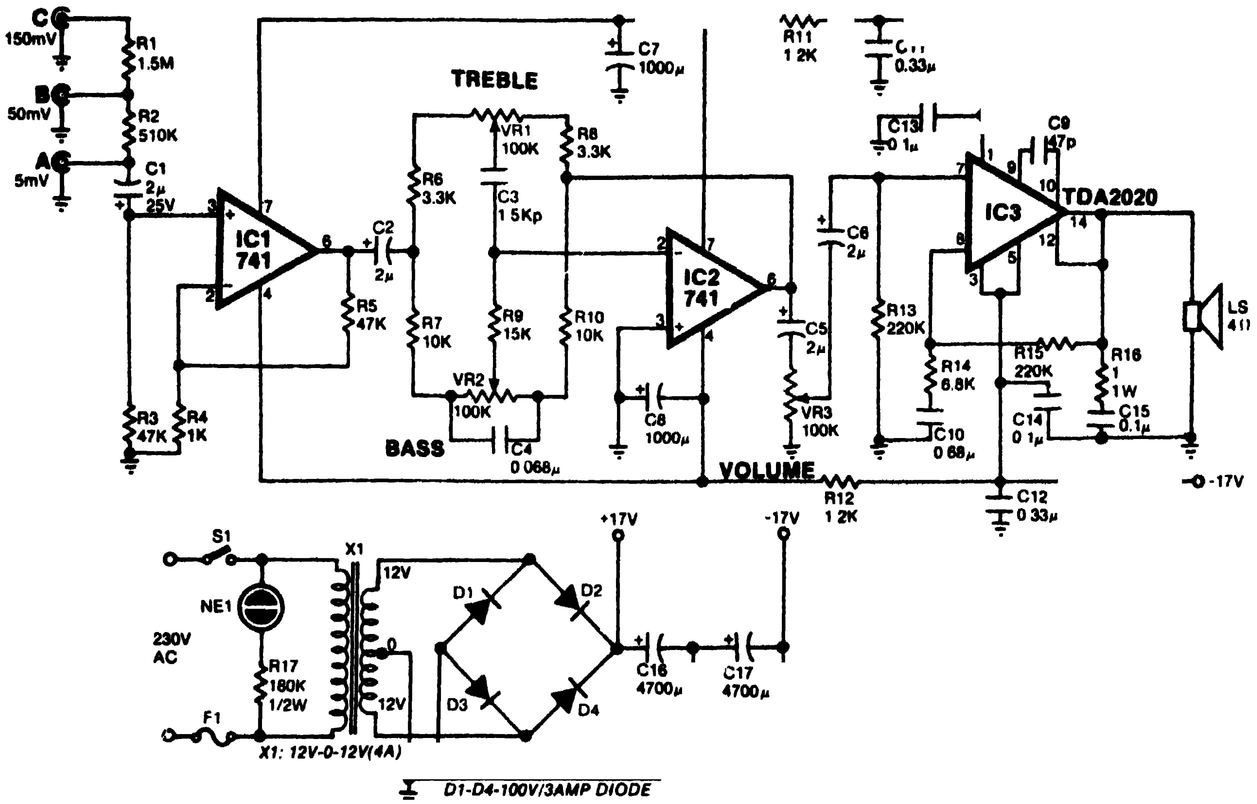


Fig. 1: Circuit diagram for one channel of a 20W plus 20W stereo amplifier; the second channel is identical.

contact with the negative or positive rail of the supply or the earth (0V). Before soldering IC3, the heatsink should be fixed. Apply a thin coat of heatsink compound (silicon grease) and mount the heatsink with suitable nuts and bolts. (They should not make contact with chassis.) After fixing the heatsink, IC3 can be soldered.

Required lengths of colour coded ribbon cable can be used for wiring volume and tone control pots. C4 is soldered over the bass control pot.

Power supply

The simplest part of this project is its power supply. It may be constructed without using a PCB.

The transformer used in the prototype had a secondary of 12-0-12 volts, rated 4A. (For mono only the current rating can be halved.) Silicon diodes of 3-amp and 100-volt reverse rating or a suitable bridge rectifier can be used. (Prototype used a bridge.) The transformer should be mounted away from input wiring side to keep the hum pick-up to a minimum.

The primary of the transformer is in series with the on-off switch of the left-channel volume control. Fuse F1 can be mounted in the back panel. A neon pilot lamp with a 180k resistor in series is connected across the primary of the transformer. The positive of the supply goes to pin 1 of IC3 and the negative to pins 3 and 5.

From PCB earth (0V) a thick wire (such as the braid of a shielded wire) should be soldered to the nearest point in the

PARTS LIST

Semiconductors:	
IC1, IC2	— LM741, operational amplifier
IC3	— TDA 2020, power amp.
D1-D4	— Any 100V, 3A diode (or bridge rectifier)
Capacitors:	
C1, C2, C5, C6	— 2μF, electrolytic capacitor
C3	1.5kpF, ceramic capacitor
C4	0.068μF, polyester capacitor
C7, C8	— 1000μF(25V), electrolytic capacitor
C9	— 47pF, ceramic capacitor
C10	0.68μF, Mylar capacitor
C13, C14, C15	— 0.1μF, polyester capacitor
C16, C17	— 4700μF (25V), electrolytic capacitor
C11, C12	0.33μF, Mylar capacitor
Resistors (all ¼watt unless otherwise stated):	
R1	1.5-megohm
R2	- 510-kilohm
R3, R5	— 47-kilohm
R4	— 1-kilohm
R6, R8	- 3.3-kilohm
R7, R10	— 10-kilohm
R9	— 15-kilohm
R11, R12	— 1.2-kilohm
R13, R15	— 220-kilohm
R14	— 6.8-kilohm
R16	— 1-ohm (1W)
R17	— 180-kilohm (½W)
VR1, VR2, VR3	— 100-kilohm (lin.)
Miscellaneous:	
X1	— Mains transformer with 12V-0-12V, 4A secondary
F1	— 500mA fuse with holder
S1	— On/off switch
LS	— Full-range speaker (4-ohm)
	— RCA sockets, speaker sockets, heatsink, PCB, ribbon cable, shielded wire, cabinet, nuts and bolts, neon, etc.

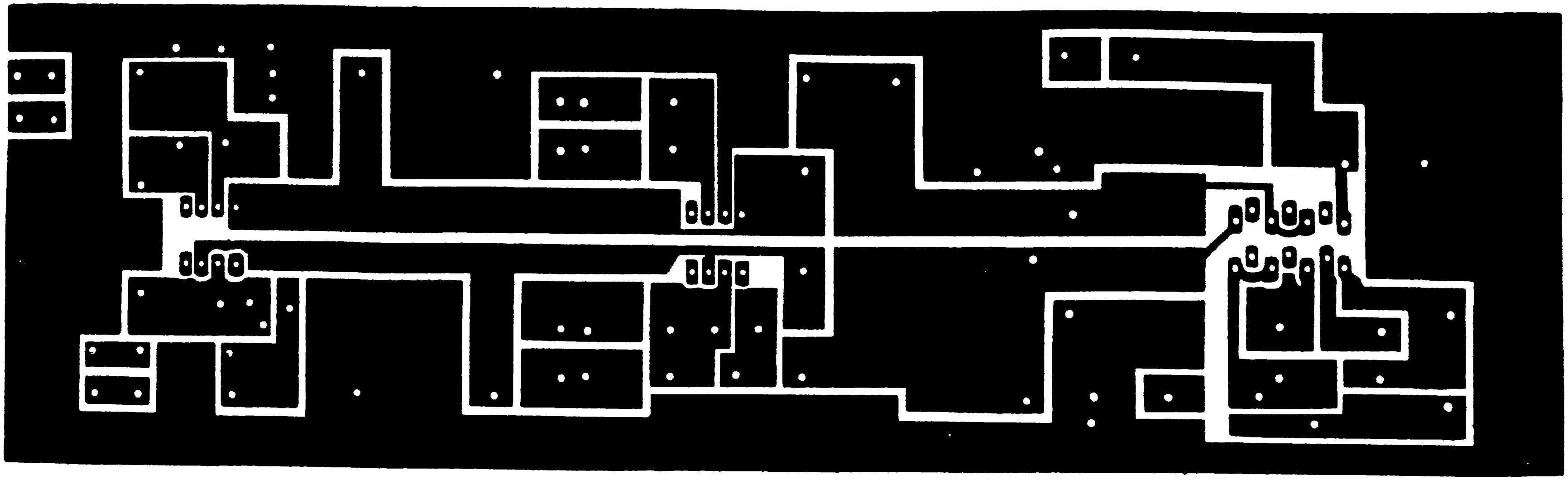


Fig. 2: Actual-size PCB layout for one channel.

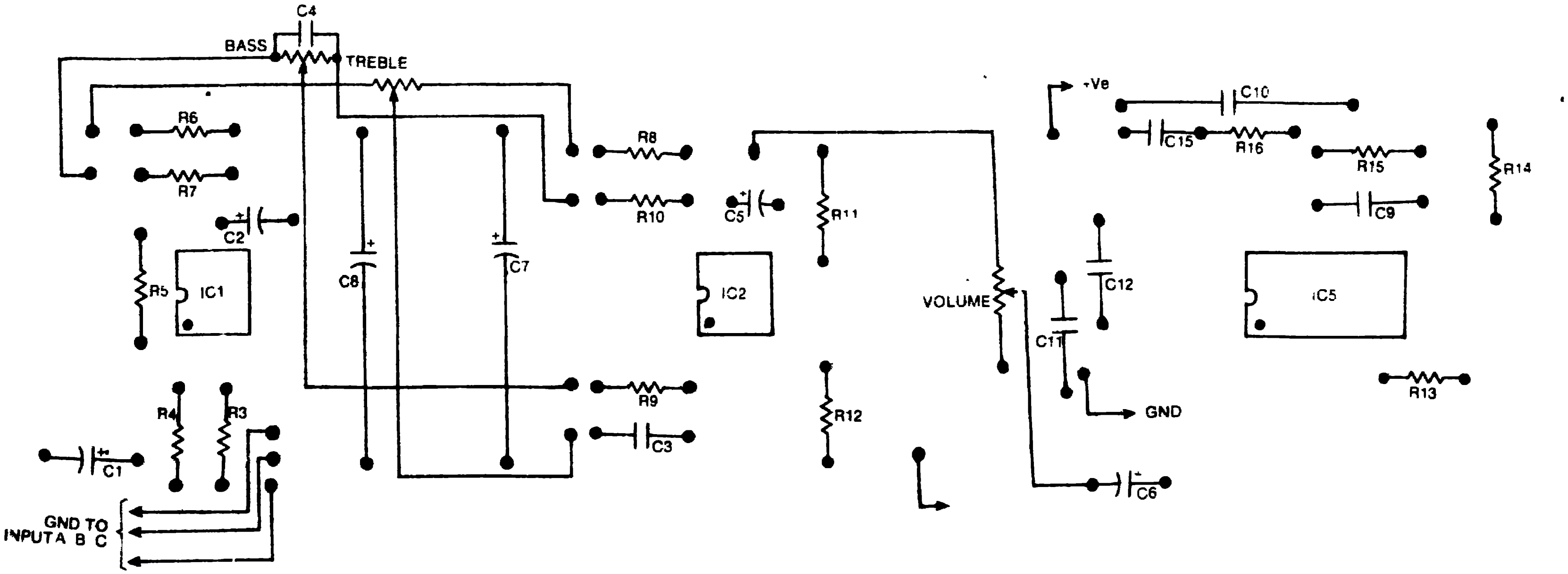
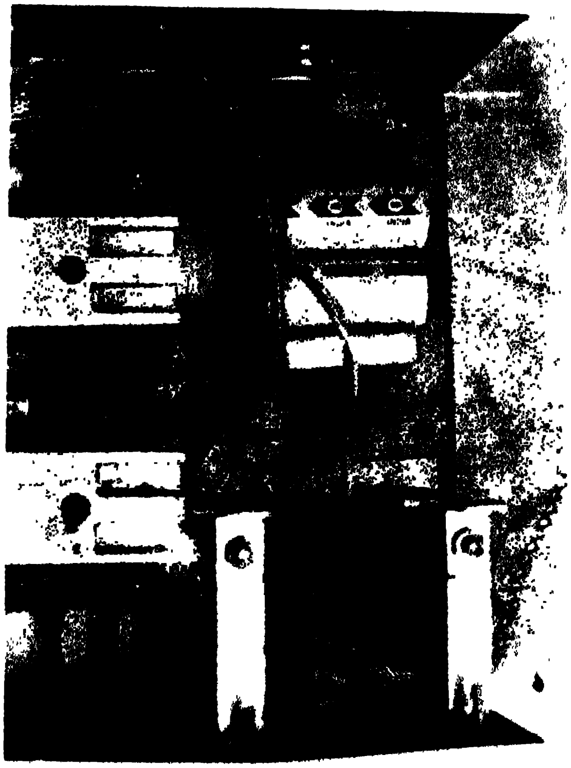


Fig. 3: Component layout for one channel.



— An inside view of the power supply section.

chassis. To the same earth point the power supply common (0V) should be soldered well. Speaker sockets can be wired from pin 14 of each TDA 2020 and the chassis point where PCB is earthed. Having a common ground point this way will help to reduce ground loops, hum and instability problems.

Input wiring

From C1 and the nearest earth point (where R3 is earthed) a short length of shielded wire is connected to input socket A. R1 and R2 are wired in series to input sockets C and B respectively. The grounds of input sockets are earthed together with the braid of input shielded wire. Mounting should be in such a way that the sockets do not make contact with the chassis. (For this RCA sockets mounted on a piece of bakelite sheet can be used.) After completion of wiring check for possible mistakes before switching on.

The PCB can be assembled using spacers and 1/8-size, 2.5cm nuts and bolts. A cabinet for housing the stereo amplifier, measuring about 32×20×8 cm, may be procured from the market.

Speakers

With the prototype full range speakers of 4-ohm impedance, 15cm dia, and 20W capacity (Bolton make) were used with suitable enclosures. R16 and C15 provide speaker damping. Sound quality obtained with various inputs was very good. ☐

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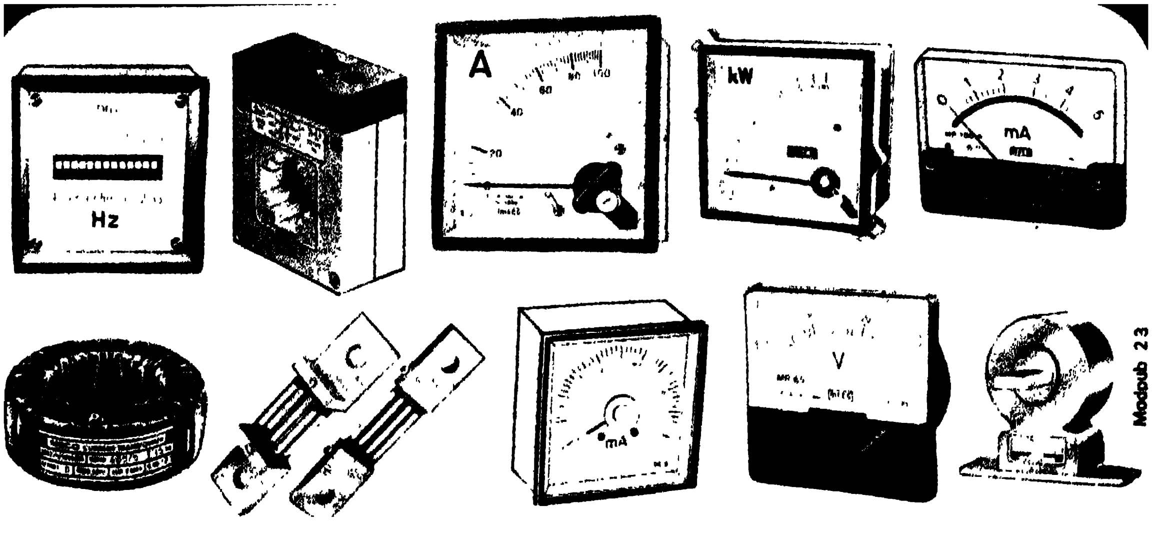

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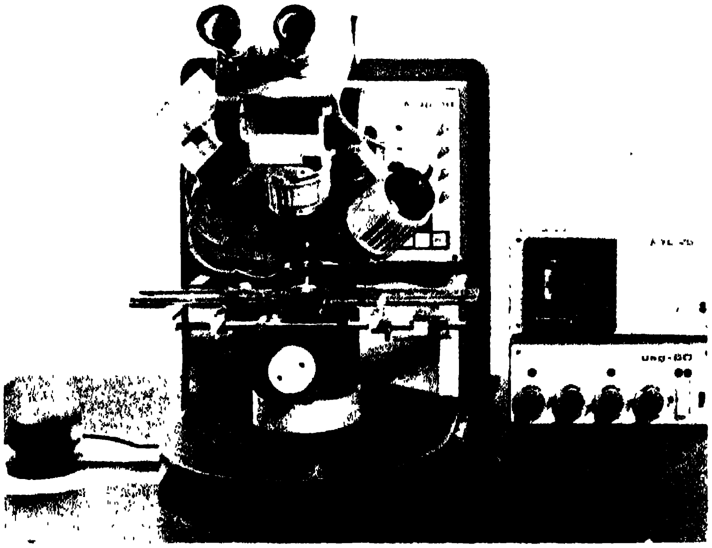

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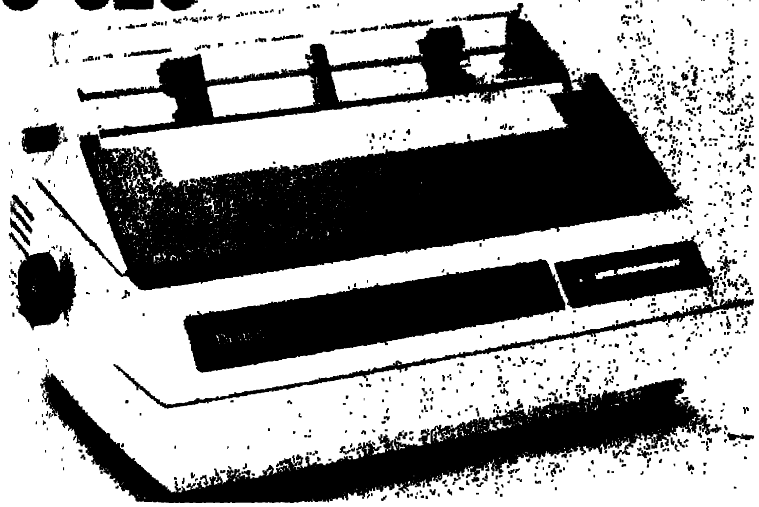

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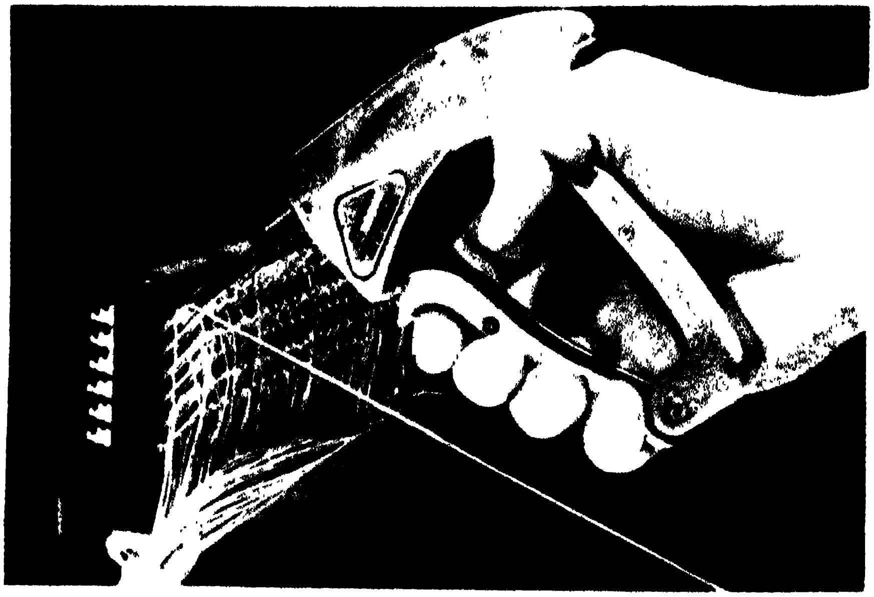

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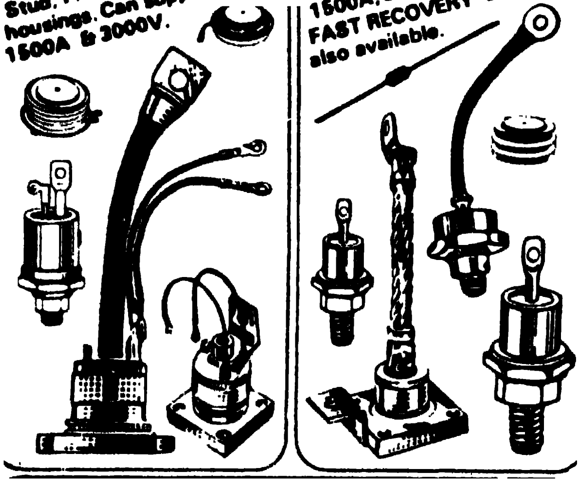

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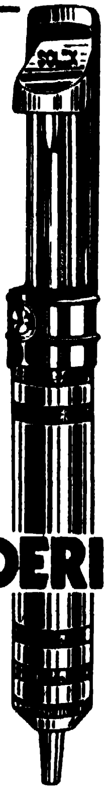

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Analogue Frequency Meter

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The Linear Scale Analogue Frequency Meter described in this article enables measurement of frequencies from less than 10 Hz to 100 kHz in four decade ranges. The instrument is easy to construct, low in cost and yet good in performance.

Input impedance of the meter is fairly high (> 200k for inputs less than 500mV peak), and the instrument is sensitive enough to respond to input signals as low as 50mV peak. The input circuitry is diode protected against input voltages as high as 100 volts.

The frequency meter operates on a single 9-volt battery. Since battery drain is fairly low, even a small Eveready type 216, 9-volt battery offers a reasonably long service life.

Principle of operation

A block diagram of the instrument is shown in Fig. 1. Sketches of the waveforms available at different stages of the instrument are shown in Fig. 2, and the circuit diagram is given in Fig. 3.

The input signal is coupled via capacitor C1. Resistor R1 along with diodes D1 and D2 limits the input voltage to IC1, thus protecting the input circuitry against high level inputs.

IC1 is a CA3140 op-amp. This op-amp has been chosen for its high input impedance, low bias current requirement and good slew rate. It is wired as a non-inverting amplifier with an AC gain of 100 and functions as a preamplifier for low level input signals. The output of this IC is directly coupled to IC2.

IC2 is an NE556 dual timer integrated circuit. The first timer in this IC is connected as a schmitt trigger by tying together the trigger and threshold terminals. The output of IC1 is given to the junction of these terminals. When the amplified input voltage exceeds 2/3 V_{CC}, the schmitt trigger output (pin 5) goes low, and it goes high when IC1 output falls below 1/3 V_{CC}. Hence, the output of the schmitt trigger is a train of square waves at the same frequency as the input signal. With a 9-volt battery, the hysteresis of this schmitt trigger is 3 volts, and transferred to the input this represents a hysteresis of 30 mV.

The second timer in IC2 is connected as a monostable multivibrator. The schmitt trigger output is coupled via C4 and is used to trigger the monostable. At each trigger, the monostable outputs a pulse whose duration is determined by the timing capacitor C7 and the range resistance selected via range selector switch S1. Specifically, the monostable duration is given by $t = 1.1 \times R_{range} \times C7$.

Thus the monostable output is a series of pulses at the same frequency as the input signal but the monostable duration for any given range is fixed. Thus changes in the input signal frequency mean a change in the duty cycle. Now duty cycle $D = t/T$, and since $f_{in} = 1/T$, so $D = t \times f_{in}$. Hence the duty cycle is proportional to the frequency of the input

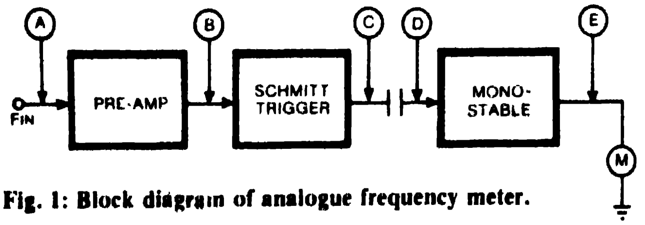


Fig. 1: Block diagram of analogue frequency meter.

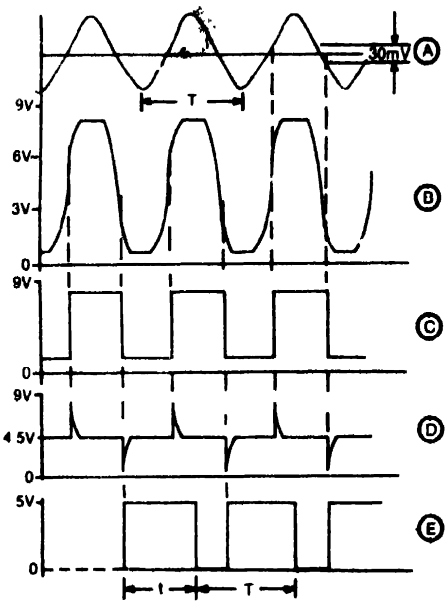
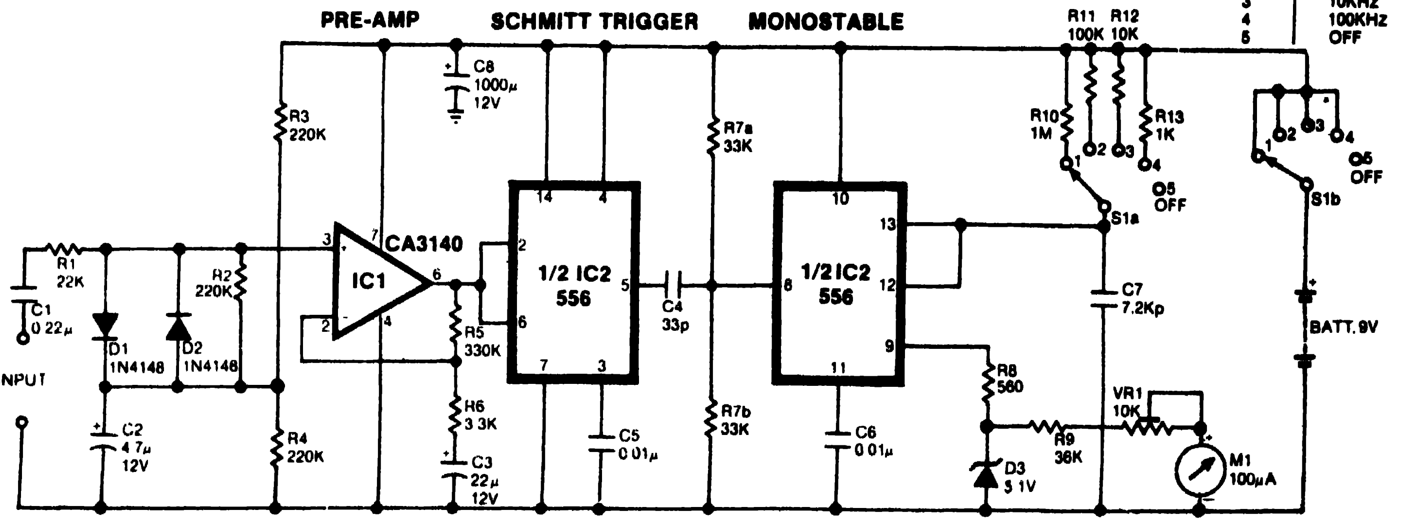


Fig. 2: Waveforms diagram.

PARTS LIST

Semiconductors:	
IC1	CA3140 operational-amplifier
IC2	NE556 dual timer IC
D1, D2	1N4148 silicon switching diode
D3	5.1V, 400mW zener diode
Resistors: (all ¼watt, ±5% carbon)	
R1	22-kilohm
R2, R3, R4	220-kilohm
R5	330-kilohm
R6	3.3-kilohm
R7a, R7b	33-kilohm
R8	560-ohm
R9	36-kilohm
R10	1-megohm, ±1% metal-film
R11	100-kilohm, ±1% metal-film
R12	10-kilohm, +1% metal-film
R13	1-kilohm, ±1% metal-film
VR1	10k horizontal preset
Capacitors:	
C1	0.22μF, 250V ceramic
C2	4.7μF, 12V electrolytic
C3	22μF, 12V electrolytic
C4	33pF, 12V ceramic
C5, C6	0.01μF, 12V ceramic
C7	7.2kpF, 12V ceramic
C8	1000μF, 12V electrolytic
Miscellaneous:	
S1	2-pole, 5-way switch
M1	100μA, moving coil ammeter
Batt	9-volt, PP3 battery
	PCB, enclosure, battery clamps, test probe with socket, IC socket etc.



S1 POSITION	FUNCTION
1	100Hz
2	1KHz
3	10KHz
4	100KHz
5	OFF

Fig. 3: Circuit diagram of the analogue frequency meter.

signal. Since the average DC level is also proportional to the duty cycle, it follows that the average DC level is proportional to the frequency of the input signal.

For proper operation of the monostable, the monostable triggering pulse should be of shorter duration than the monostable width. To accomplish this, the schmitt trigger output is differentiated by the C4-R7a-R7b network to provide a series of negative going triggering spikes at the same frequency as the input signal.

To avoid inaccuracies which may arise due to falling battery voltage, the monostable output is clamped at 5.1 volts by zener diode D3. 5.1-volt zener diodes have a low temperature coefficient and hence their breakdown voltage remains practically unaffected by temperature changes.

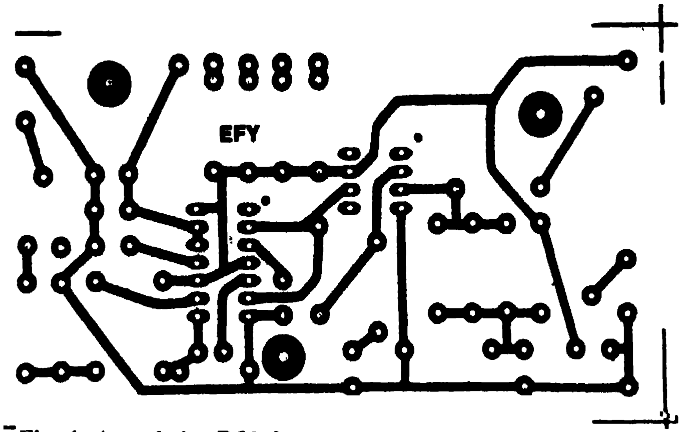


Fig. 4: Actual-size PCB layout.

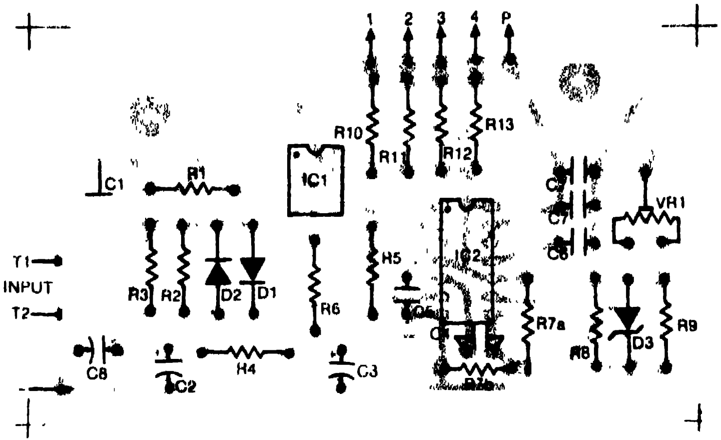


Fig. 5: Component overlay.

The output thus obtained is given to the 100μA moving coil type meter through the current limiting resistors R9 and VR1. In the meter, the current pulses from the monostable are averaged and the meter deflection, which is proportional to the average DC level, indicates the frequency of the input signal.

Construction

The circuit may be assembled on an IC type (2.55 mm) strip board. If available, the use of glass epoxy strip board is recommended.

For those who would prefer to etch their own printed circuit board, the printed circuit pattern (foil side) used in preparing the PCB of the prototype is shown in Fig. 4 and the corresponding component overlay is shown in Fig. 5. As before, the use of glass epoxy material for the PCB is recommended.

It is better to solder the integrated circuits directly onto the printed circuit/strip board rather than make use of IC sockets. No special precautions need be taken with IC2, this being an ordinary bipolar device. However the CA3140 is an MOS device and the precautions usual to the handling of these devices ought to be observed.

To facilitate easy and accurate measurements, a 100μA meter movement with a large mirror backed scale is recommended. Either screw type terminal binding posts or a BNC socket may be used for the input terminals. Range resistors R10 to R13 are metal-film, +1% tolerance types.

Calibration

If an accurate signal/function generator is available, it may be used to calibrate the instrument. Adjust for a level of about 1-volt peak and connect the generator output to the input terminals of the instrument. Switch to the appropriate range and adjust VR1 so that the meter indicates the correct frequency.

If an accurate generator is not available, the following calibration procedure may be adopted: Switch the instrument to the 100Hz range and connect to its input terminals the 6-volt or 9-volt secondary winding of a mains step-down transformer. Energise the transformer from the 230V, 50Hz mains and adjust VR1 for a 50μA meter reading.

Use

In use, it is always advisable to start with the highest range (i.e. 100 kHz) and work downwards until a reading is obtained beyond the lower 10 per cent of the scale. The instrument is automatically switched on via range selector switch S1(b) which is ganged to S1(a) when switched to any of the ranges 1 to 4, and switched off when the range switch is in the 'off' position.

S1 must be switched to the off position when the instrument is not in use to avoid unnecessary drain on the battery. When measurements are being made, the input terminals must not be touched as this could affect the accuracy of the measurement. Also, it is not advisable to power the instrument off the mains with an adaptor.

The approximate cost of the instrument, exclusive of a case and an indicating meter, works out to Rs 150. A suitable 100μA meter movement may be obtained for between Rs 150 and Rs 250, depending on its size and accuracy. ☐

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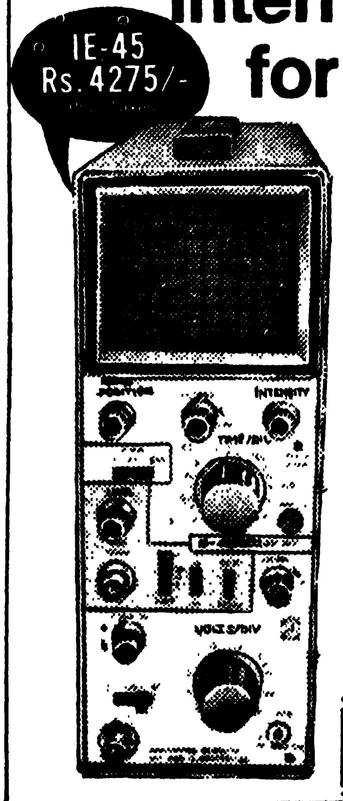

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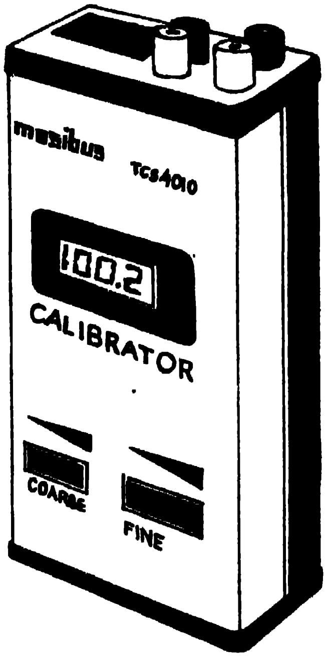

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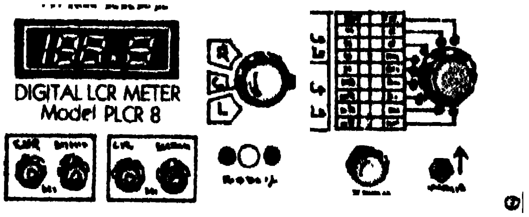

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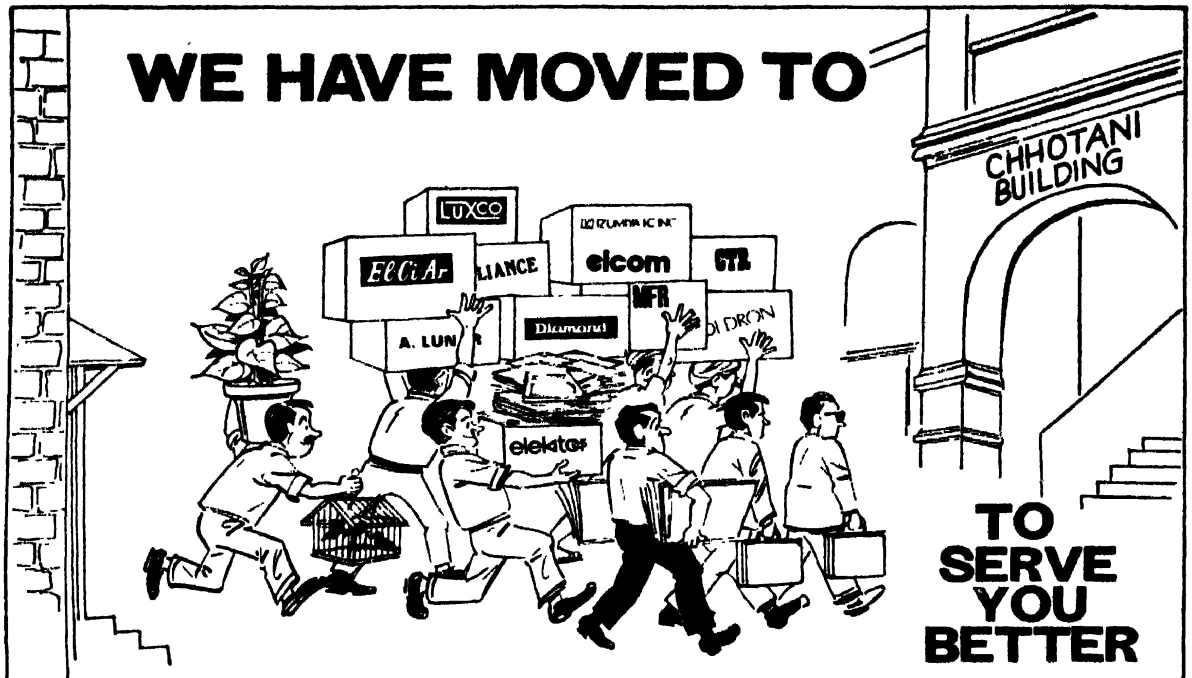

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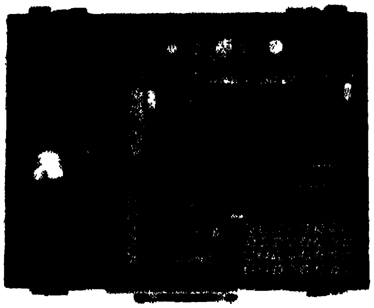

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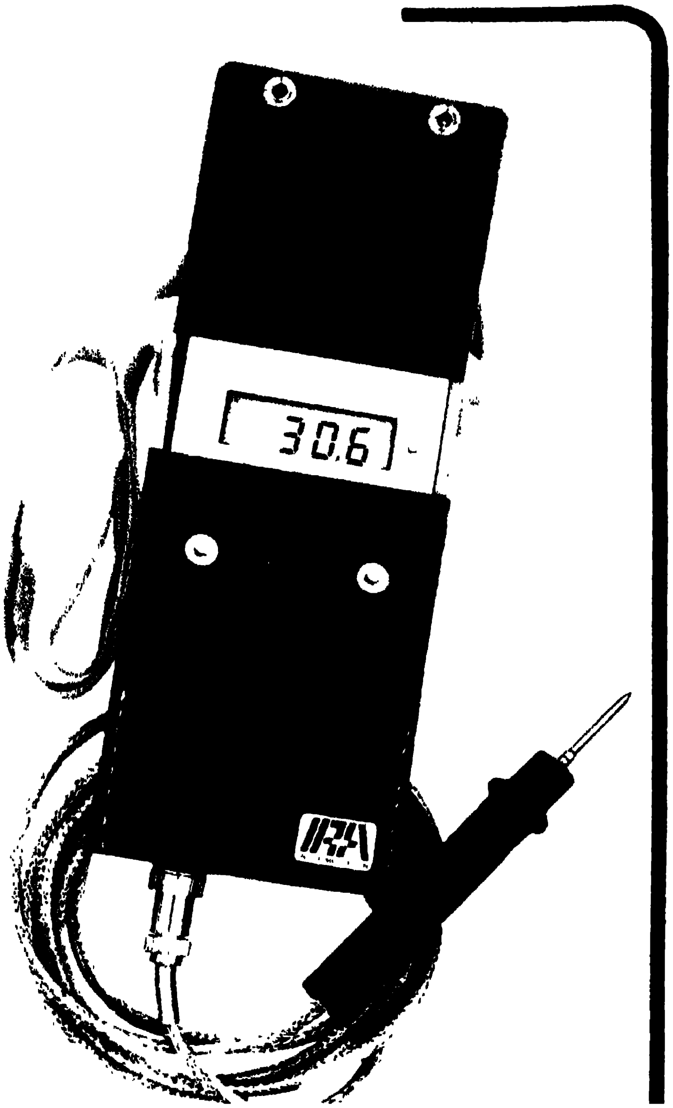

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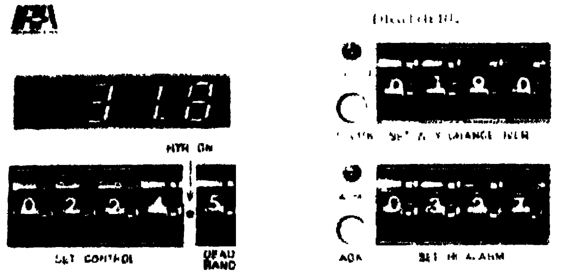

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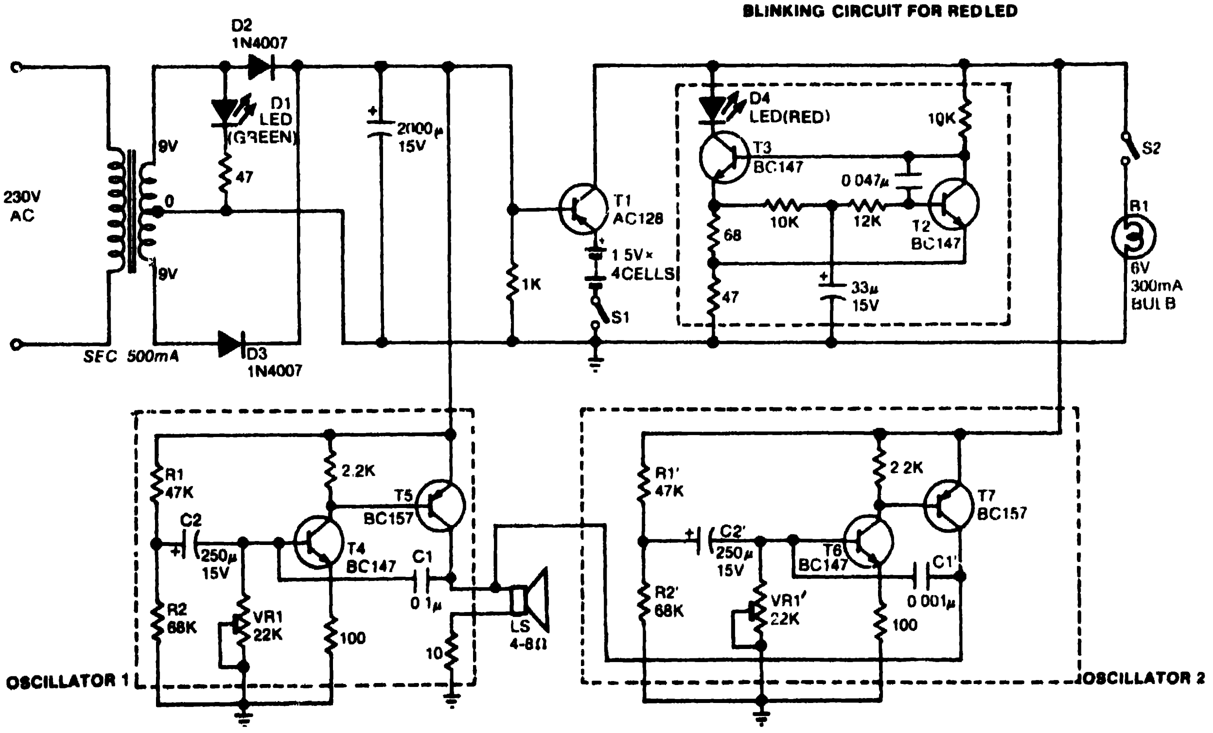
Many a times AC mains power fails all of a sudden. This may cause inconvenience, particularly late in the evenings. Here is a circuit which can give visual as well as audio alarm whenever AC mains power is interrupted.

Whenever AC power is present, a green LED (D1) will be glowing. But if the power goes off, then a red LED (D4) will start blinking and the green LED will go off. Simultaneously an audio alarm will start indicating failure of mains power. The alarm shuts after the preset time, but the red blinking LED continues to glow until AC mains power is restored back.

When power resumes, again an alarm starts- but this time with a different sound. This alarm also shuts off after the preset time. The blinking red LED now goes off and the green LED glows, indicating presence of mains power.



With this facility one can easily say whether the power has gone off or has been restored back merely by hearing the sound. Moreover, one need not rush to the equipment when the alarm starts to shut it off, because the alarm shuts off automatically.

Lots of variations are possible in the circuit shown. The frequency of the two oscillators can be changed to one's choice by changing the value of capacitors C1 and C1'. The preset time to shut off the alarm can be adjusted by varying potentiometers VR1 and VR1' in the circuit shown for oscillators.

Also, the blinking circuit of red LED comprising T2 and T3 and some other components can be removed and red LED can be connected directly between collector of T1 and ground, with a suitable resistance in series with it. This makes the circuit simple and easy to assemble.

The whole circuit is built around transistor T1. When mains power is present, T1 is kept off so that the supply to red blinking LED and oscillator 2 in cut off; supply is available to green LED and oscillator 1 from the stepped-down AC mains. Capacitor C2 acts as a short in the beginning and therefore T4 gets supply through R1 and the oscillator operates. As capacitor C2 starts charging through VR1, it cuts off the supply to T4 after having fully charged. Hence the oscillator stops its operation after some time.

As soon as mains power goes off, the capacitor discharges through R2, and T1 is now 'on'. Thus, red LED and oscillator 2 gets supply from cells and supply to green LED as well as oscillator 1 is cut off. Bulb B1 also gets supply from the cells and it acts as an emergency light source, when even switch S2 is closed in absence of mains power. Switch S1 is provided to switch off the circuit when not required.

AMANULLA KHAN

Solidstate Relay

The advantages of a solidstate relay over a conventional electromechanical relay are well known. The former has a higher reliability. There is no arcing or sparking since there are no mechanical make-break contacts. And since zero-switching is not possible in an electromagnetic relay, it produces RF interference.

The circuit given here is of a versatile solidstate relay which could be used to switch gadgets operating on 230V AC. The load handling capacity of this relay depends upon the triac used. There is 100 per cent isolation and insulation between the input and output since these are coupled together by an optocoupler.

Control voltage at the input is fed to the LED in the optocoupler through R1. The LED current should be around 15 mA, and assuming a drop of 1.5V, the value of R1 could be calculated.

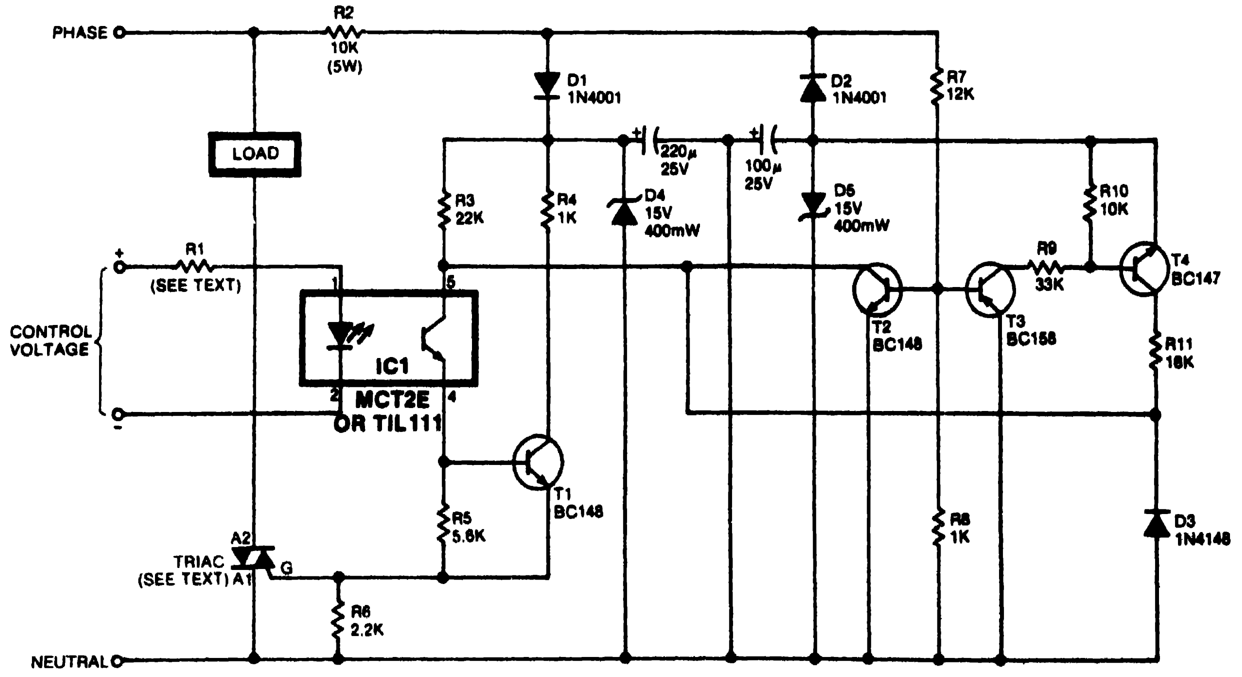
The transistor in the optocoupler conducts whenever the control voltage is applied. If T2 and T4 do not conduct, the triac gets fired. Since we want the triac to get triggered only at the zero crossing, the circuit comprising T2, T3 and T4 is added.

T2 conducts whenever the phase voltage becomes more than 8V with respect to neutral, while T3 and T4 conduct when the phase voltage becomes less than -8V with respect to neutral. When either T2 or T4 conducts, the base bias for T1 is cut off and hence the triac gets fired only when the phase voltage is within ±8V.

Strictly speaking, this is not zero switching. Switching at zero voltage is not possible because the triac needs a minimum holding current to latch on. D3 protects the optocoupler from getting reverse biased when T4 conducts.

The load handling capacity of this circuit depends upon that of the triac used. Triacs of various ratings made by different manufacturers are available in the market. The choice is left to the user, so that he may select according to his needs. But there are some points to be noted. The minimum voltage of the triac has to be 400V for resistive loads and 600V for inductive loads. Triacs should always be fitted with proper heatsinks. A triac has a minimum current rating called the holding current. The RMS load current should always be more than twice the rated holding current.

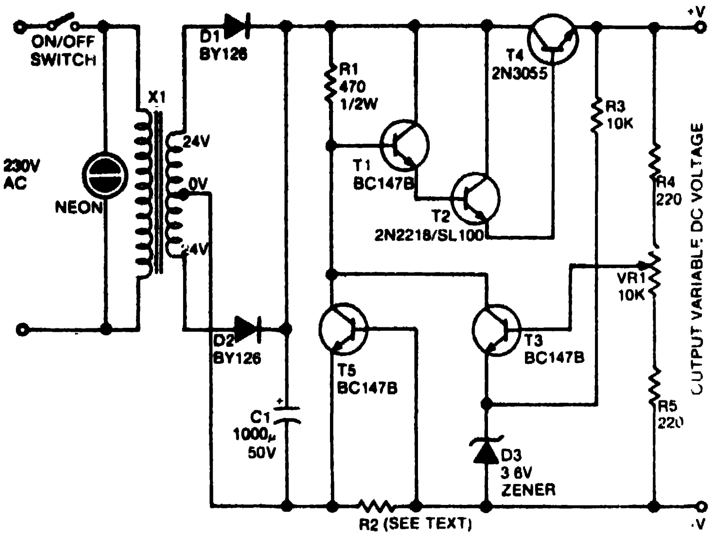
R. SHANKAR



Regulated Power Supply

No test bench is complete without a regulated power supply. So, here is an interesting and useful circuit which gives 0.3% line regulation and 0.2% load regulation; output voltage can vary continuously from 4.6V to 30V and is capable of providing up to 3 amperes of current. It has short-circuit protection as well as current limiting capability from 16 mA to 1 ampere.

Transformer X1 in the circuit provides full-wave 24V AC. Diodes D1 and D2 rectify the voltage. After filteration by C1 it will supply nearly 30V DC. The main principle of the regulator is that when T3 conducts more, T4 conducts less—causing the output voltage to decrease. When load sinks higher current, the output voltage decreases and thus a lower voltage is fed to the base of T3. Now, due to decreased conduction of T3, R1 provides sufficient current to T4, through series-pass darlington pair comprising T1 and T2, to increase the output voltage to the extent that it comes back to its original level. Hence the regulation is achieved.



By varying VR1 the output voltage can be changed from 4.6V to 30V. Variation in line voltage tends to change the output voltage but again the input voltage is restored as before and regulation is achieved.

Transistor T5 and resistor R2 constitute the short-circuit and overload protection circuit. Current limiting transistor T5 starts conducting beyond a set load current determined by R2. Once Vbe drop of this transistor exceeds 0.6 volts, T5 conducts and current flowing to T1 and T4 gets grounded. Hence, the output voltage and current decrease to very low levels.

Likewise, when output terminals are shorted, more than 0.6 volt develops across R2 and output gets reduced to a voltage and current that does not affect the load.

As T4 is a power transistor (2N3055) which draws very large current, it must be mounted on a sufficient heatsink

To vary output current limiting point from 60 mA to 1 ampere, we must alter R2 from 10-ohm to 0.5-ohm respectively; 2.2-ohm resistor is sufficient for 300mA load.

A limitation of this circuit is that we cannot achieve voltages less than 4.6V DC, as we may not get lower voltage zeners with good temperature coefficient values.

G. RAVIKUMAR

Have You Any Idea?

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A token honorarium (minimum Rs 50) will be paid for the ideas found acceptable for publication. But please see that your contribution fulfils the following two conditions:

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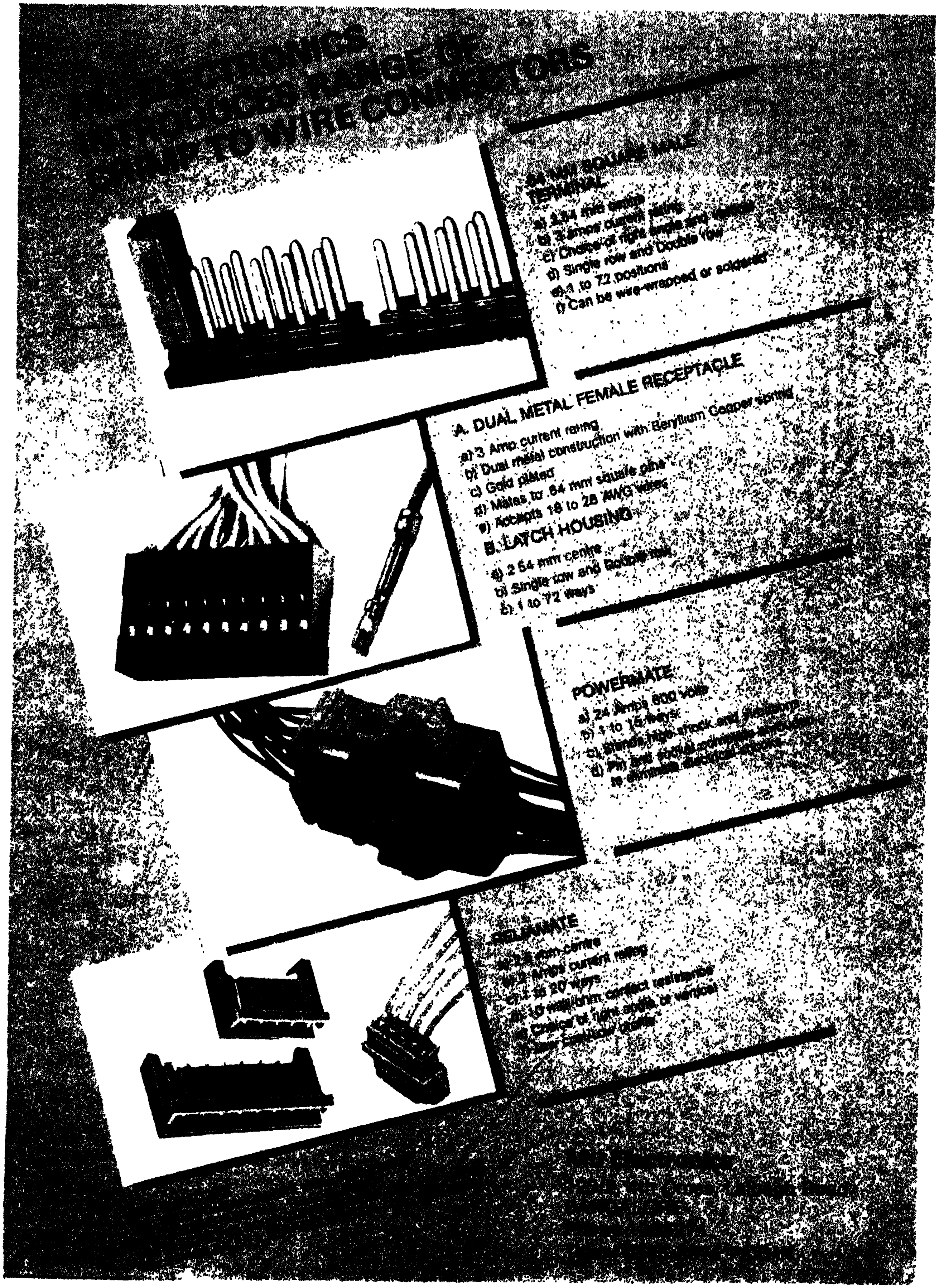

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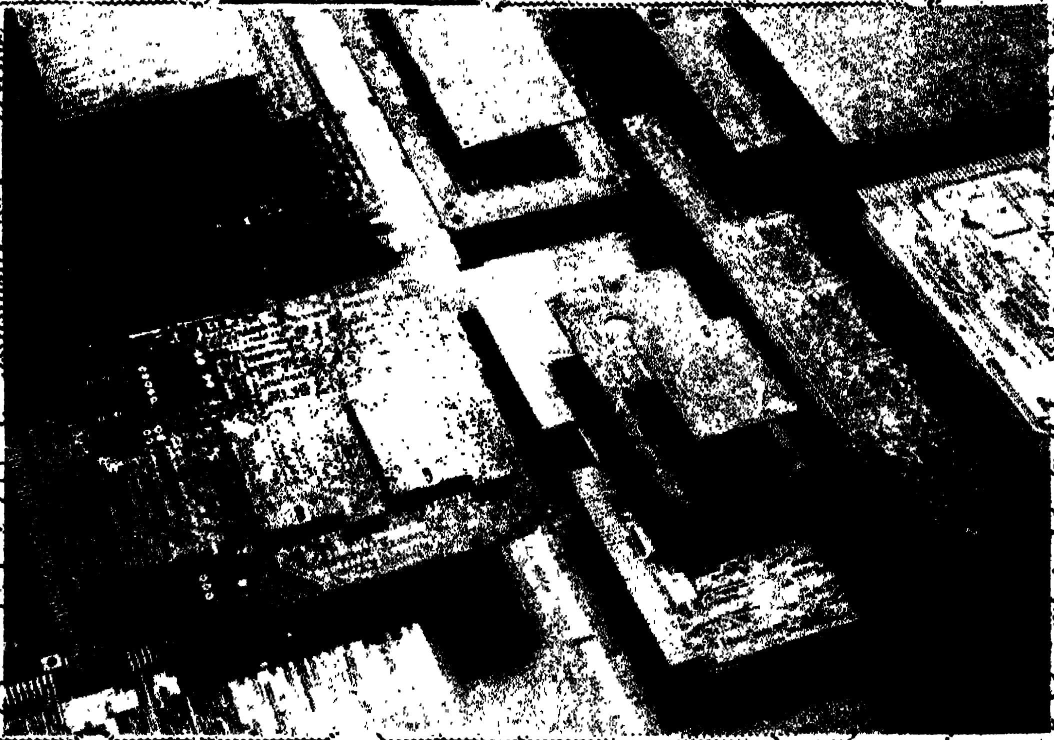

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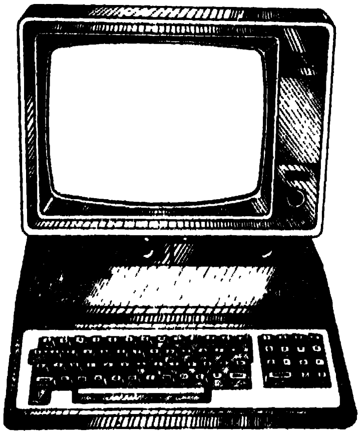
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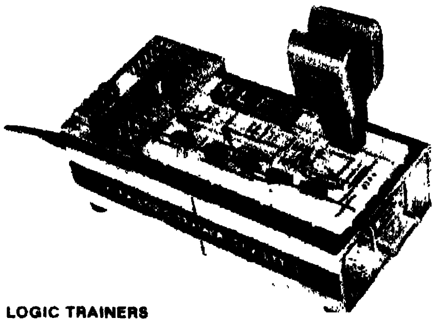
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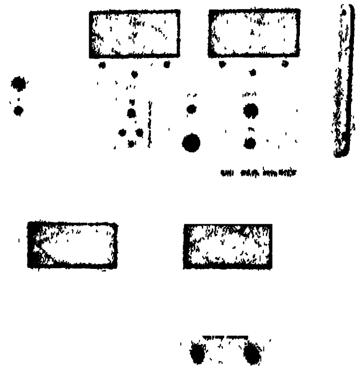
UNINTERRUPTIBLE POWER SUPPLY SYSTEMS

Spectron manufactures a wide range of Uninterruptible Power Supply (UPS) Systems The present range includes single phase output up to 5kVA and three phase output up to 10kVA. Systems with single phase or three phase inputs are available.

UPS systems find their application wherever AC power supply is required without even a millisecond's interruption. This is achieved by inverter working on DC power supply, which draws power from mains normally and switches over to storage batteries when mains supply fails. The instantaneous switching over is done by automatic solid-state static switches.

The typical applications of UPS systems are: back-up power supply to computers, vital instrumentation controlling, continuous chemical processes, microprocessor based systems, communication equipments and biomedical electronic/electrical equipments.

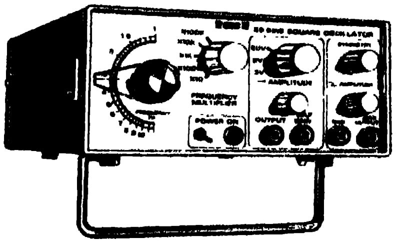

UNINTERRUPTIBLE POWER SUPPLY SYSTEMS

Contact: Electron Sales & Service Pvt Ltd, 63 Bharatkunj No. 2, Erandvane, Pune 411038.

SINE AND SQUARE GENERATOR

EIS-56 is a portable sine and square wave generator from Intimate Electronics It uses the latest solidstate and MOS-LSI technology with glass epoxy PCB. Both sine and square waves are simultaneously available on two separate output connectors.

Frequency range for sine and square waves is from 10Hz to 1MHz in five decades continuously variable Output amplitude for sine wave is 10mV to 30V peak to peak in three decades continuously variable, while for square wave it is continuously variable from 0-10V peak. The dial accuracy is ±5% ±1°


SINE AND SQUARE GENERATOR

EIS-57 with frequency range 20Hz to 200kHz is also available

Contact: Intimate Electronics, 70/10 Mohammedi Manzil, Mohammed Ali Road. 1st Floor, Bombay 400003.

DIGITAL TEMPERATURE CONTROLLERS

IRA's new Digitherm-1000MC series Digital Indicating Temperature Controllers are available with one, two and three set points. Set points with or without dead band could be used for on/off control, high and low alarm control, pump control, star-delta changeover control or external function control. In case of dead band control set point, the dead band is programmable on the front panel from 1°C to 9°C.

DIGITAL TEMPERATURE CONTROLLERS

It is equipped with 3½-digit LED display with accuracy of 0.5 per cent. Broken sensor alarm and trip circuits. built-in calibration check facility, alarm acknowledgement switches, relay energised condition indicators and over-range indicator are special features

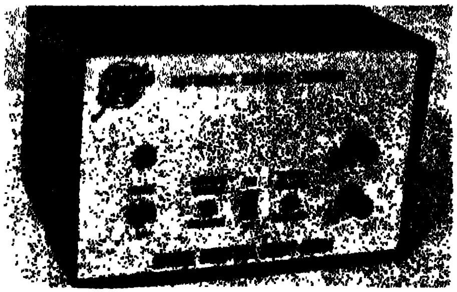
Due to use of CMOS logic, controllers are highly immune to noise and electrical disturbances. Optional. facilites include parallel BCD output, time proportional on/off control

facility and digital printer.
Contact: Instrument Research Associates Pvt Ltd, No. 79/1-2, Magadi Road, Bangalore 560023.

AUTOMATIC BATTERY CHARGERS

Advance Industries has presently come out with different models of Automatic Battery Chargers from 6V to 36V and currents up to 6A

It is a solidstate thyristorised charger with under voltage and overvoltage cut-outs. It is short circuit proof and can also be used for charging highly discharged battery. It has overvoltage cut-out and current limit adjustment facility/control. It is also protected against reversed battery connection. All these protections are provided with LED indications for ease of operation.

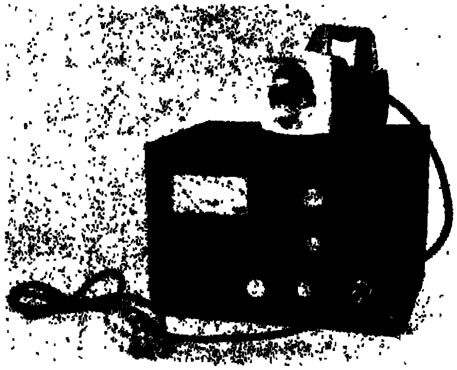

AUTOMATIC BATTERY CHARGERS

Contact: Advance Industries, Tinwala Building, Tribhuvan Road (Near Dreamland Cinema), Bombay 400004.

FIELD BALANCING EQUIPMENT

This portable Field Balancing Equipment by ACD Machine Control enables the correction in balancing of rotating parts to be carried out without dismantling the machine, thereby saving a lot of labour and down time.

It gives better results than the conventional balancing, as it can detect and correct the residual unbalance as well as unbalance due to assembly. The equipment costs fraction of the conventional equipment, as the jobs are driven in their own body with their own power source.


FIELD BALANCING EQUIPMENT

It can be used extensively for periodically monitoring vibration levels for preventive maintenance. Equipment is complete with components like vibration pick-up, strobe light, turnable filter and indicating meter as well as buffer amplifier.

The equipment is designed for Indian conditions keeping in mind the difficulties experienced by our field engineers. Front panel simplicity as well as internal electronic circuit design is most useful for Indian environment.
Contact: ACD Machine Control Company (P) Limited, E-6 Udyog Sadan-2, M.I.D.C. Andheri (East), Bombay 400093.

AC DRIVE SYSTEM

Advani-Oerlikon has developed a specia solidstate AC Drive System named 'Ador Ampvert' for variable speed control applications. It is designed for use with AC squirrel cage induction motor which is the most reliable primemover available today for high power industrial applications.

The system enables bidirectional speed control with regenerative braking using the principle of current source inverter. It maintains a constant voltage frequency ratio ensuring constant torque operation in the overall range. Its important feature is that during reversal or during deceleration in either direction, it prevents wastage of mechanical energy by regenerative action. This is done by feeding the energy back into the mains supply. These factors enhance the economy and the efficiency of the overall system

AC DRIVE SYSTEM

Modular in construction, the system comprises power components, control switchgear and PCB rack fitted in standard cubicles. It incorporates safeguards like electronic overcurrent trip, under voltage trip and overvoltage trip It is designed to suit 3 phase, 415V, 50Hz, AC supply line.
Contact. Advani-Oerlikon Limited, GPO Box No. 1546, Bombay 400023.

PHOTORESIST

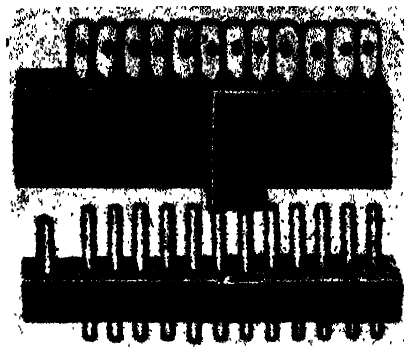
Yasino Resist is a stabilised formulation based on carefully synthesised photopolymer and organic solvents This purified Photoresist offers improved resolution, better adhesion, etch resistance and low pinhole density

Yasino Resist complies with the critical and exacting requirements for all types of PCBs and photofabrication processes. It has uniform molecular weight and size distribution with workable spectral sensitivity and sense of electronic purity. Its drying time is 10-15 min. at room temperature in dark.

Auxiliaries like developer, dye and thinner are also available.
Contact: Yasino Polychem, 1001 A Khan Bhag, Sangli, Maharashtra 416416.

MINI PCB CONNECTOR

Om Lila's has introduced mini PCB connectors used in colour and B/W TV's, tape recorders, electronic instruments, computers, etc

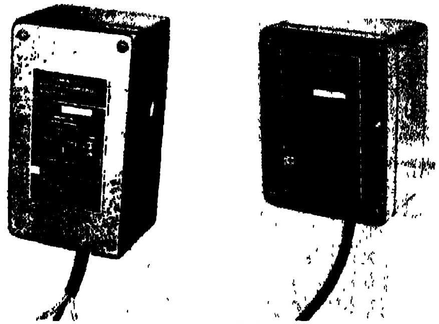

MINI PCB CONNECTOR

Range of availability is: 1 to 8 pin and 10, 12, 14, 16, 18, 20 and 22 pin. The male part is directly soldered on to the PCB and wires on the female part of the connector are soldered. Wire connections can be easily connected/disconnected during servicing or testing.
Contact: Om Lila's, Plot No. 84-A/B, Govt. Ind. Estate, Kandivlee (W), Bombay 400067.

AUTOMATIC TWILIGHT SWITCH

Emlite Automatic Control Switch provides automatic switching on and off operation at dusk and dawn of electrical systems like electrical lights, bulbs, tube-lights, mercury vapour lamps, sodium vapour lamps, halogen lamps etc. The principle of working of Emlite is based on photo sensitive light dependent resistor (LDR) whose electrical resistance varies with the intensity of light incident on it.

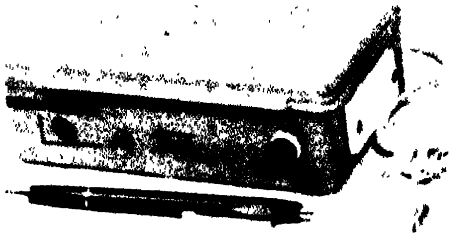
Emlite provides trouble free operation at temperatures as high as 85°C and it is tropic proof, shock and vibration resistant. The continuous exposure to sun and rain has no harmful effects


AUTOMATIC TWILIGHT SWITCH

It is ideal for street lights, airports, seaports, hospitals, offices, factories, railway yards, hoarding lights, neon signs, factory compound lights, bunglow lights, staircase, porch and lobby lights
Contact: National Electronics, 105 Princess Street, Damodar Bldg, 2nd Floor, Bombay 400002

CLAP SWITCH

Elektro-World has manufactured a sound sensitive clap switch for turning various electrical appliances on and off.



CLAP SWITCH

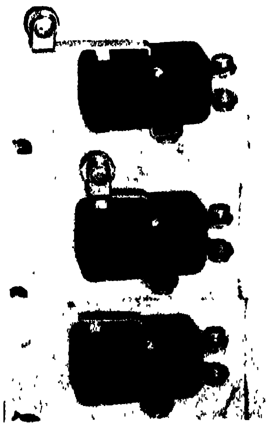
The battery-operated model works on 6V DC battery and has a small-size PCB The mains-operated model works on 220V AC. The operative range of both models is 6-9 metres. It can take loads up to 500W.

Contact: Elektro-World, 48/B Harpal Nagar, Moradabad, UP 244001.

MICRO SWITCH

Raj Micro Switch is a versatile switch with snap action. It has a short, medium and long integral lever. The lever is also available with roller on it.

It is used in control gear in industrial application It is also used in panel boards, instruments, electronic equipments, intercoms and video games etc. The body and cover is moulded out of electrical grade phenolic powder, as well as melamine in case of special requirements.



MICRO SWITCH

Contact: Raj Industries, 118 Gurunanak Udyog Bhavan, L.B.S. Marg, Bhandup, Bombay 400078.

MICA PARTS

B.R. Enterprises are manufacturers of various types of Mica Parts which are the best electrical insulating material.

The mica parts available are: semiconductor mounting mica washers; mica insulators for various electronic and electrical machines, equipments and components, mica gaskets for boiler gauge glass packing; mica sheets, cut plates, strips discs and foils; mica power and flakes.

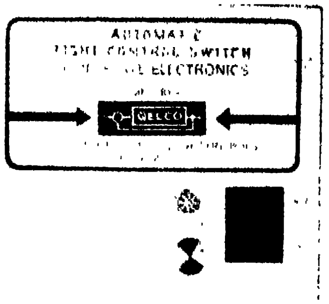
Micanite products like tubes, bushes and tapes are also available

Contact: B.R. Enterprises, 91 Netaji Subhas Road, 2nd Floor, Calcutta 700001.

AUTOMATIC LIGHT CONTROL SWITCH

Gelco Automatic Light Control Switch has been designed to turn the light on/off at dusk/dawn irrespective of the sun set/rise time It uses ICs and works on the principle of light dependent resistor

It is provided with starting and final delays to overcome the effect of cloud and lightning respectively. It has auto off/manual switch and neon indication It is of single-phase supply model in 10A and 25A. Its overall size is 17mm × 165mm × 85mm. The switch weighs 1 15 kgs.



AUTOMATIC LIGHT CONTROL SWITCH

Contact. Gujarat Electronics & Controls, 9 Advani Market, Outside Delhi Gate, Ahmedabad 380001.

ALL-PURPOSE MARKERS

Tiger Management Services offers imported all-purpose Marking Pens which can be used for writing on cartons, cardboard boxes and sheets, metallic sheets and components, plastic materials, textiles, PCBs, porcelein articles and insulators, photographic plates and on transparent sheets for use in projectors.

These pens can also be used for corrections in blueprints, for marking on wooden boxes, enamel painted boards, aluminium foil type papers and waxed papers. These multipurpose pens and inks and are available in red, black and violet colours.

Contact: Tiger Management Services, 10 Apparsamy Koil Street, Mylapore, Madras 600004.

MULTIPLE OUTPUT POWER SUPPLY

IMEC Multiple Output Power Supply model 1601 is a versatile DC power source for digital ICs, linear ICs and general purpose laboratory applications.

For digital circuits there is 4.5 to 5.5V variable output with short circuit and over voltage crowbar protection. -15 to 0 and +15V outputs at 500mA with autotracking facility and short circuit protection are useful to linear IC circuits. In addition, 0-30V continuously variable output at 2A is ideal supply for general purpose laboratory requirements. All these outputs are electrically isolated from each other

MULTIPLE OUTPUT POWER SUPPLY

There are two front panel meters to monitor output voltage and current of 30V. Use of silicon semiconductors ensure high reliability and permit power saving operation at full load up to 50°C ambient temperature.

Contact: Intel Micro Electronics & Control, 410/A Gandhinagar Highway, P.O., Ranip, Gota, Ahmedabad 382480.

DEFLECTION YOKES

Constantine Engineering Laboratories Company, USA are manufacturers of a large variety of deflection yokes for CRTs, deflection amplifiers, precision display systems, micropositioners, TV camera deflection components, and a host of other sophisticated products.

Deflection yokes for typical deflection angles 42°, 52°, 70° and 90° are readily available. They have high sensitivity, high resolution, wide bandwidth and are low in costs. Deflection yokes suitable for various sizes of CRTs and also meeting all standard deflection requirements are available.

DEFLECTION YOKES

Contact: Echbee Corporation, 38 Cawasji Patel Street, Bombay 400001.

AUTORANGING PICOAMMETER

Keithley Instruments Inc , manufacturers of low current measurements, has introduced a new, high performance digital picoammeter. The 4½-digit Model 485 Autoranging Picoammeter is low priced and combines the economy and operational convenience of a DMM with the sensitivity of a scientific instrument. The Model 485 measures currents from 0.1pA to 2mA.

The Model 485 Picoammeter exceeds the performance of previous models with an additional decade of sensitivity and resolution. An IEEE-488 option (Model 4853) allows the Model 485 to be interfaced with a number of popular instrument controllers for small systems applications. All front panel controls are programmable through the bus. An optional rechargeable battery pack allows portable operation for up to six hours.

Additional features include fast autoranging, relative (differential) measurements, 100-point data storage with minimum/maximum reading hold, and a log current display mode. Digital calibration can be performed over the bus and helps to lower life-cycle cost of ownership.

AUTORANGING PICOAMMETER

Contact: Micronic Devices, 54/1, Old Rajinder Nagar, New Delhi 110060.

LOGIC ANALYSER

MLA 3300 Logic Analyser manufactured by Meguro Electronic Corporation, Japan, is a compact, low cost and light-weight analyser with 16-channel data input and has maximum resolution of 100 ns at 10MHz.

The liquid crystal display gives the analyser very low power dissipation in logic circuits, making possible battery-powered operation where no other power source is available. The analyser is designed to measure timing, state and signature and can be used in many applications from hardware to software.

Its 256-bit storage acquisition and referece memory have memory back-up, which can be later analysed in detail. Its powerful trigger functions including works, glitch-detection and clock delay, send all assigned data into memory. A menu method makes it easy to set each operation mode.

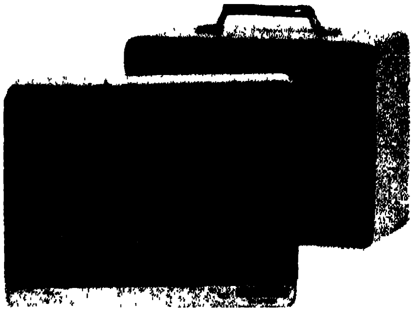
Contact: Khatau Engineering Services Pvt Ltd, Laxmi Building, 6 Shoorji Vallabhdas Marg, Ballard Estate, Bombay 400038.

TOUGH INPUT DISPLAY TERMINALS

General Digital Corporation USA has manufactured Vuepoint, a gas plasma display terminal for computers which combines alphanumeric display of 24 lines of 40 characters, microprocessor controller and built-in power supply.

It has a special feature of touch input sensing whereby upon touching the display screen at a sensitised location, information is sent to the host computer and audible feedback is given to the user. This eliminates the need of conventional keyboard for input to the computer for menu driven programmes.

Vuepoint features standard RS232 computer interface with selectable 300 to 19,200 baud rate ASCII characters and simple to use escape sequences make it suitable for use with all computers. It can store up to 48 pages of memory.

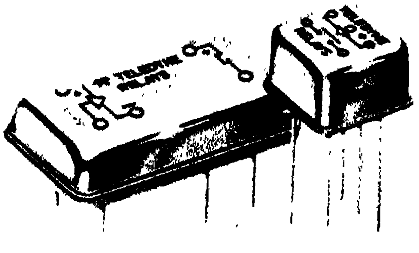

TOUGH INPUT DISPLAY TERMINALS

Contact: Latest Technic 13/6 Jawahar Society, Govind Nagar, Borivli, Bombay 400092.

POWER FET SWITCHING HYBRID

Teledyne Relays, USA has introduced a high-speed Power FET Switching Hybrid. The Teledyne M85F and M90F SSR's are designed to replace electro-mechanical relays in many applications such as low level and high voltage switching.

Teledyne's M85F and M90F feature typical rise times of 300 to 600 microseconds, and fall times as fast as 90 microseconds. The all-hybrid microelectronic construction utilises the latest power FET technology in the output stage. The new units may be driven by CMOS or TTL logic families by being configured in a five or four terminal mode respectively.



POWER FET SWITCHING HYBRID

Since the power FET output appears to be very low resistance (0.5 to 1.2 ohms) with no offset voltage, applications such as thermocouple and low level analogue switching can be accomplished. The hybrids multiplexing can be accomplished directly from microcomputer I/O ports or CMOS ring counter circuits. The M85F and M90F can also be used to set the gain of the instrumentation amplifier under microprocessor control due to zero offset.

The M85F and M90F allow clean bounce-free switching at speeds unattainable with electromechanical relays. They have typical on-resistance of 0.3 ohms for the DC hybrid.

Contact: Teledyne Relays, 12525 Daphne Avenue, Hawthorne, California 90250, USA.

PROCESSOR WITH J11 CHIP

Being the first to use the powerful J11 chip from Digital Equipment Corporation MDB Systems USA has developed a versatile, high-speed front end communications processor that allows true co-processing for the first time on the Q-bus. Primarily, this enables smaller, less costly systems to have the processing power of larger, more expensive systems.

The new Model MLSI-JFEP11 features an on-board 512KB megabyte dual ported memory that provides completed messages direct to the processor; two high-speed serial ports (one megabaud each), and an external parallel bus to facilitate unlimited I/O expansion.

This powerful new front end processor is ideal for multi-processing applications, and also eliminates the need for costly external CPU-based communications systems, line switches and protocol converters.

PROCESSOR WITH J11 CHIP

Contact: MDB Systems Inc., 1995 North Batavia Street, Orange, CA92667, USA.

WIRE 2 COMBINATION

Eraser Company, USA, has announced a Wire 2 Combination of cable reel lifting, dereeling, measuring and coiling equipment for the preparation of large wires and cables in the electrical and electronic industry. It comprises a heavy duty cable reel lifter and dereeler, a measuring meter, and a coiling device.

The Wire 2 Combination will produce accurately measured coils of material from bulk reels/drums of wire or cable. Coils of material containing up to 475 m may be prepared and the Combination will accommodate bulk cable reels or drums up to maximum diameter 91.5 cm and weight of up to 450 Kg.

WIRE 2 COMBINATION

The three units that comprise the Wire 2 Combination are all floor mounted and easily adjustable for different size cables and specific applications.

Contact: The Eraser Company Inc., P.O. Box 4961/Oliva Drive, Syracuse, New York 13221, USA.

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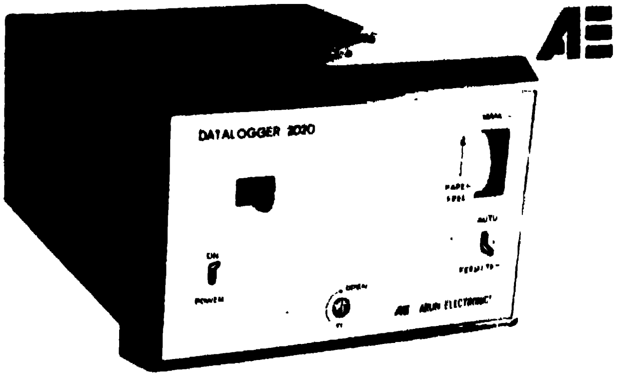

ALPHA NUMERIC PRINTERS

(DATA LOGGER)

FEATURES

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- Universal Input Standards
- Data in ASCII Format
- Software Commands enhance Performance
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- Impact or Thermal Printer Mechanism
- Optional Graphic Facility in Thermal printers

SPECIFICATIONS

● Data Input	8 bit parallel (TTL Level) or Full serial input RS232C
● Data Code	ASCII 96 Characters
● PrintPosition	20 positions/line
● Rate Speed	1.8 lines/Sec
● Power Supply	230V AC ± 10%
● Commands	Software based, CR, LF, MF, etc

Applications

Print out of μP based systems
Cash Register, Electronic Scales
Data Acquisition Systems,
Micro-Computers, Medical Electronics

For details contact

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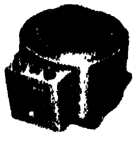
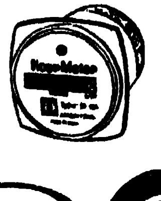
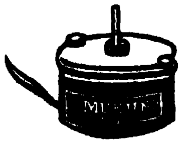


HourMeter



MINIATURE SYNCHRONOUS
MOTORS
WITH REDUCTION GEARS.



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ITI designs new digital exchange

The Indian Telephone Industries (ITI) in Bangalore has designed and developed for the first time in the country, a completely digital exchange called 'digital integrated local-cum-trunk exchange' (digital ILT exchange).

The digital ILT exchange, developed in association with the P&T Telecommunication Research Centre, New Delhi, has multipurpose applications.

The exchange, which is a highly sophisticated common control digital switching system, can work as a local tandem or trunk exchange or any combination. It provides for 64 lines which can be expanded up to 2048 lines. The switching control is accomplished by multi microprocessor control configuration.

Diagnostic circuits have been provided in the system, enabling quicker detection of faults. The exchange provides many facilities to the subscriber such as malicious call tracing, called subscriber alert and call waiting. The charges on trunk calls made by every subscriber can be registered and detailed billing of calls for a predetermined period can be made.

The first digital ILT exchange manufactured by ITI was commissioned recently at Udayamperoor near Ernakulam.

ELCOT signs contract to manufacture display systems

Electronics Corporation of Tamil Nadu (ELCOT) has recently entered into an agreement with Southern Magnetics to manufacture computerised electronic score boards electronic information display systems for railways, airlines, stock exchanges, stadiums and advertising etc.

The display system employs high visibility flap modules, which are ideally suited for high ambient light condition. category in which to find a particular reference.

Vimal offers nine-track computer tapes

Vimal Enterprises, a small-scale unit manufacturing audio magnetic tapes without any foreign collaboration, has come out with nine-track, professional grade computer tapes on reels.

The tapes, manufactured by TRI, USA, are processed by Vimal at its plant at Umbergaon, Gujarat and packaged on reels made in India as per international specifications. Computer tapes are entirely imported in the country and this is a positive step towards import substitution to save foreign exchange.

Vimal, a pioneer in the audio magnetic tape industry with established brand name and quality acceptance, has now stepped in the field of more sophistication, with a view to ultimately manufacture computer tapes indigenously in collaboration with TRI for which a letter of intent and foreign collaboration approval has already been obtained. The project is expected to go in production by March 1985 and will be the first of its kind in the country.

Manufacture of pulse dialler LSIs begins at SCL

Semiconductor Complex Limited (SCL) has recently gone into the production of pulse dialler LSI semiconductor circuits, type 2560 G, of its foreign collaborator, American Micro Systems Inc., for electronic telephones, 4.19MHz and 32kHz LSIs for quartz analogue clocks, 16k dynamic random access memories (RAMs) and certain custom/semi-custom LSI circuits. SCL is already manufacturing time keeping modules and subsystems for analogue and digital electronic watches and clocks.

SCL will be manufacturing MOS LSI devices of the following types:

- 8-bit microprocessor/8-bit microcomputer and peripheral devices like versatile interface adaptor (VIA), RAM input/output timer (RIOT), read only memories (ROM) etc for data processing applications
- Pulse dialler, single chip/channel codec and custom LSI devices for electronic switching systems, for telecommunication applications.
- Static, dynamic and programmable memories like 64k dynamic RAM, 16k static RAM, 64k/256k E^2 PROM.
- Time keeping circuits for digital electronic switches, quartz analogue watches and clocks.
- Custom/semi-custom circuits for various industrial and scientific applications.

The SCL-Rockwell licence and technical assistance agreement provides for the transfer of knowhow for the following LSI devices:

- 8-bit microprocessor, type R 6502
- 8-bit microcomputer, type R 6500/1
- Versatile interface adaptor, type R 6522
- 128k RAM I/O timer, type R 6532
- 32k ROM, type R 2332.

The agreement provides for transfer of all technical documentation and training of SCL engineers by Rockwell relating to circuit design mask making, wafer processing, device assembly, testing, quality and reliability assurance and application.

The agreement is for eight years and provides for exclusive licence to manufacture the licensed products. There is a provision for sharing of improvements in product specifications design and manufacturing during the term of the agreement. It also provides for the licensing by Rockwell to SCL at SCL's option of additional LSI circuits like peripheral interface adaptor (PIA), type R 6520, CRT controller, type R 6545, ROM, RAM input/ output timers R 6530 and R 6531.

IMPORT AND EXPORT OF COMPUTERS

The total number of computers costing Rs 500,000 and above cleared for import during 1981, 1982 and 1983, along with the total foreign exchange involved is given below:

	1981	*1982*	*1983*
Total Number	22	51	10
Total Foreign Exchange (Value Cleared) (Rs in million)	278	276	50

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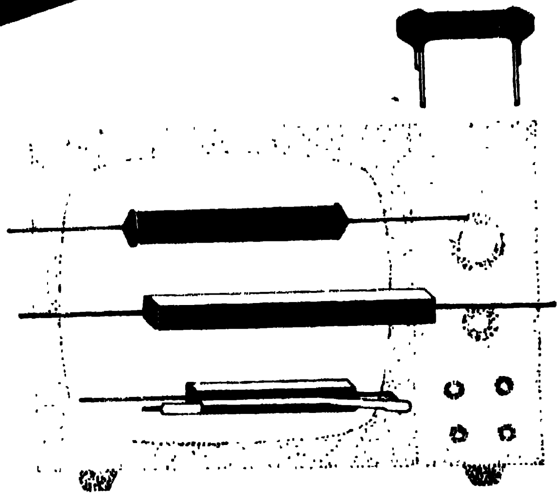

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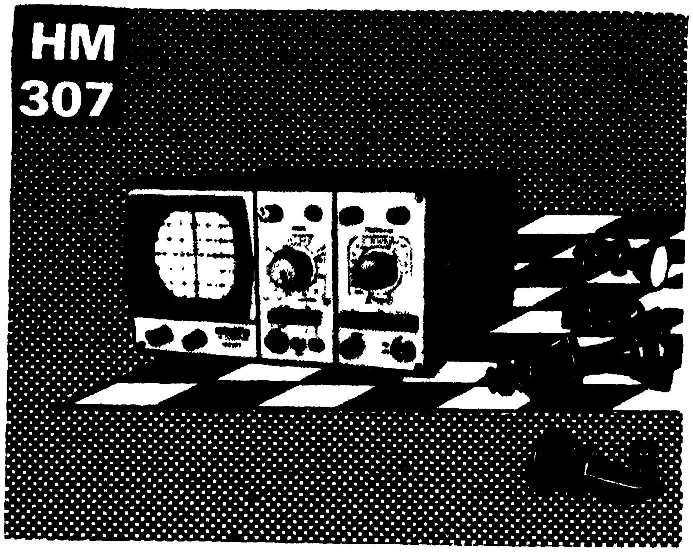

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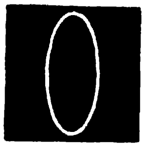
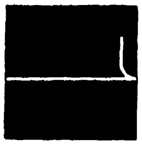
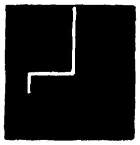


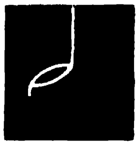
Capacitor 33 uF



Transistor E C



Transistor B E



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  (-6 db): 15 MHz
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- Sensitivity: 5mV—20V/cm
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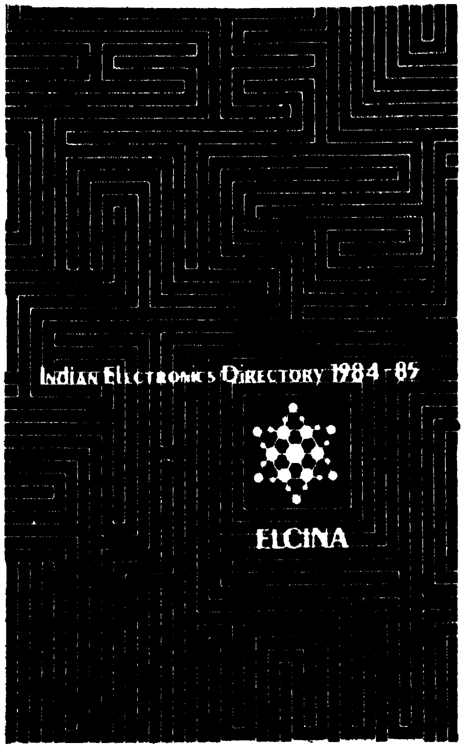
Indian Electronics Directory 1984-85

Published by Elcina, 408 Sahyog, 58 Nehru Place New Delhi 110019; pages 250 (size 21.5cm × 31cm); hard cover; price: Rs 100.

In the mid-sixties, the Bhabha Committee Report had stressed the need for a self-reliant indigenous electronic components industry. Any such local industry existing at that time was insignificant. Most of the components were imported from advanced countries, though there was a growing awareness for a coordinated development of such industry.

It was at such a time that the Electronic Components Industries Association (Elcina) was established by seven existing units of the industry. With the rapid growth of the industrial units of electronic components, the membership of the association has now risen to over 200.

In an effort to present the information and statistics of all units—large, medium and small—manufacturing electronic components in one volume, Elcina has compiled this directory. It is a comprehensive collection of data on the Indian electronics industry and gives information through the most modern method of indexing.



The directory is based on a detailed indexing of major manufacturers of electronic equipment and components. Apart from a special alphabetical index of Elcina members, there is a comprehensive list of over 1500 such manufacturers in the country.

A manufacturers' product guide represents an index of the industry by products. Nearly 400 categories and sub-categories are provided for ease of consultation. The relevant manufacturers along with their locations are listed against each product. A summary index of product categories precedes the guide as a short reference list to assist a quick assessment of method followed for indexing products and the category in which to find a particular reference.

Apart from these main indexes, the directory is augmented by information on government policies, the industry's prospects, facilities and incentives for entrepreneurs and information on standards specifications, R&D laboratories, government departments and industry associations. The directory also contains a highly informative advertisement section featuring special company profiles.

This is the fifth revised edition of the directory, and has been produced very attractively. It is a volume which is definitely a must for every member of the electronics industry.

—R.B.

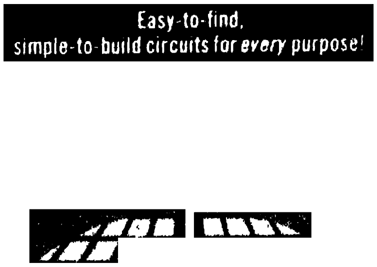
The Master Handbook of IC Circuits

By Thomas R. Powers; published by Tab Books Inc., USA; first edition (1982); pages 532 (13cm × 21cm); soft cover; price: US$ 14.95.

The book contains 932 circuits designed around linear ICs, voltage regulators, CMOS ICs, TTL/LS integrated circuits, radio and TV ICs and some special-purpose devices. It is full of circuits; no space has been wasted in describing the circuits as most of them are simple-to-build and self-explanatory.

One can find a circuit for almost any purpose in this book, whether it is for measuring time intervals, generating special effects or sounds, or to convert frequency to voltage or vice versa. Six complex sound generator circuits are given—for gunshot/explosion, race car motor/crash, steam train/prop plane, bird chirp, musical organ and siren/space war-phasor gun—all built around the popular 76477 IC. In addition, six circuits for sound generator with audio amplifier are available, based on the 76488 IC.

The circuits have been listed alphabetically, in accordance with their applications, under the Index at the end of the book. They have been grouped in the book in accordance with the IC they are built around. This arrangement is helpful in making the best use of an IC. In all 212 different ICs are required for building the circuits given in this book.



The ICs have been referred in this book only by their generic numbers. Some manufacturers add prefixes like LM (National), SN (Texas) and CA (RCA), which have been omitted here.

Most readers are likely to find many new applications in this book for the ICs they may already be having in their junk box. The book is indeed an encyclopedia of simple IC circuits.

—R.C.

LICENCES AND LETTERS OF INTENT

The following licences and letters of intent were issued to electronics firms under the Industries (Development & Regulation) Act, 1951 during the months of May, 1984.

Name & Address of the Applicant and location of the undertaking	Date & type of licence	Article	Quantity per annum
(1)	(2)	(3)	(4)
LICENCES			
Mini Circuits Private Ltd Dhun Building, 827 Mount Road, Madras (Jigani-Karnataka)	3.5.84 (NU)	Hybrid micro circuits	1 no
Derby Electronics (P) Limited 16 Hare Street, Calcutta. (24 Parganas-West Bengal)	4.5.84 (NU)	Cassette tape deck mechanism	2 nos.
Wipro Information Technology Limited Bakhtawar (14th Floor), 229 Backbay Reclamation, Bombay. (Mysore-Karnataka)	6.5.84 (SE)	Minicomputer/microprocessor based systems	Rs 60 million
Gujarat Communications & Electronics Limited Express Building, R.C. Dutt Road, Baroda (Baroda-Gujarat)	9.5.84 (NA)	1. Portable 1.9 cm VTR	200 nos
		2. Studio 1.9 cm VTR	200 nos.
		3. Three tube colour camera	50 nos.
		Editing control	100 nos.
		Camera control unit	30 nos.
Meltron Instrumentation Limited Plot No 214, Backbay Reclamation, Raheja Centre, 13th Floor, Nariman Point, Bombay. (Sindhudurg-Maharashtra)	11.5.84 (NU)	Minicomputer/microprocessor based systems (capacity approved ISE) (Factory husuorer, value of Rs 20 million per annum in first two years of the commencement of modaition capacity from third year onwards will be determined after review of progress made in first two years)	20 million
Ceat India Multitronics Pvt Ltd J-42, NDSE Part-I, New Delhi (Gurgaon-Haryana)	11.5.84 (NA)	Colour TV receiver sets	25,000 nos
Rajasthan State Industrial Development & Investment Corporation Ltd Udyog Bhavan, Tilak Marg, Jaipur (Jaipur-Rajasthan)	11.5.84 (NA)	Colour TV receiver sets	25,000 nos
OEN Micro Systems Ltd Tripunithura Road, Vyttila, Cochin. (Ernakulam-Kerala)	14.5.84 (SE)	1. Keyboards (capacity after exp.)	3000 nos.
		2. Floppy disc drivers (capacity after exp.)	1500 nos.
		3. Printers (capacity after exp.)	750 nos.
		4. Form programmers	500 nos.
Continental Device India Limited COC-120, Naraina Industrial Area, New Delhi (Faridabad-Haryana)	14.5.84 (NA)	Colour television sets	50,000 nos
Sigma Engineers (Prop. Sigmalon Equipment Pvt Ltd) W. 3, 'S' Block, MIDC, Bhosari Industrial Area, Pune (Pune-Maharashtra)	16.5.84 (COB)	Minicomputer/microprocessor based systems (5 systems having ex-factory value of Rs 300,000 or less each)	5 systems
Magnetix (India) Ltd M.S. Nagar, Tulsipur, Cuttack. (Puri-Orissa)	19.5.84 (NU)	Hard ferrites	1200 tonnes

(1)	(2)	(3)	(4)
Karnataka State Electronics Development Corpn Ltd 'Emlyn Haven', 30 Race Course Road, Bangalore. (Bangalore-Karnataka)	28.5.84 (COB)	Black-and-white TV receivers	10,000 nos
Semcon Electronics Pvt Limited Seksaria Chambers, 135 Naqindas Master Road, Bombay. (Bombay-Maharashtra)	29.5.84 (NA)	Miniature relay coils (in numbers)	3 million
International Computers Indian Manufacture Ltd Ahmed Nagar Road, Pune. (Pune-Maharashtra)	30.5.84 (SE)	Minicomputers/microprocessor based systems (capacity after expn in rupees million)	60 million
LETTERS OF INTENT			
Al-Ameen Commercial & Industrial Co. Ltd No 23/1, 2nd Floor, Crescent Road, Bangalore (Bangalore-Karnataka)	8.5.84 (NU)	Carbon film resistors Metal film resistors	140 million no 40 million nos.
Techno Laboratories (India) Pvt Ltd 60, Bentinik Street, Calcutta. (Panjim-Goa)	9.5.84 (NU)	Video magnetic tapes	500 MRM
U P Electronics Corporation Ltd 10, Ashok Marg, Lucknow (Backward Area-Uttar Pradesh)	9.5.84 (NU)	1. Audio magnetic tapes of 6.85 mm width 2. Video magnetic tapes of 12.30 mm width	1750 MRM 500 MRM
AAG Rola Magnetics Pvt Ltd 147 Poonamallee High Road, Maduravoagal, Madras. (Chingleput-Tamil Nadu)	22.5.84 (SE)	Ferrite magnets (capacity after expn)	1000 tonnes
A L. Prasad 6.3.654 Nava Bharat House, Somagiguda, Hyderabad (Medak-Andhra Pradesh)	22.5.84 (NU)	1. Electronics grade ceramics 2 With end caps 3. Carbon potentiometers	300 million nos 500 million nos 6 million nos
Madras Motors Ltd 16, Whites Road, Madras (Puddukkottai-Tamil Nadu)	22.5.84 (NU)	1. Conventional type flywheel magneto 2. Ignition coil 3 Electronic ignition flywheel magneto 4. Electronic ignition box 5 Rectifier 6. Regulator	250,000 nos. 500,000 nos 250,000 nos 500,000 nos. 500,000 nos. 500,000 nos
Jyoti Limited P.O. Chemical Industries, Baroda. (Baroda-Gujarat)	24.5.84 (NA)	Programmable logic control systems	75 nos.
Himachal Pradesh Mineral & Industrial Development Corporation Limited Circular Road, Simla (Solan-Himachal Pradesh)	26.5.84 (NU)	Printed circuit boards	20,000 sq mt
Indian Telephone Industries Ltd 16 Museum Road, Bangalore. (Bangalore-Karnataka)	26.5.84 (NA)	Fet. low-noise amplifiers (Fet. LNA) 4GHz associated switch control panels	40 nos.
P. Palaniappan 235 Mint Street, Madras. (Chengalpattu-Tamil Nadu)	28.5.84 (NU)	Metallised plastic films (capacitor grade)	180 tonnes
J&K State Industrial Development Corpn Ltd Drabu Building, Ram Bagh, Srinagar, Jammu & Kashmir (Badgam-Jammu & Kashmir)	28.5.84 (NU)	Video tape (MRM of ½" or 12.7 mm width) video cassettes	500 MRM 2 million nos
Manohar Lal Tandon 37 Merry Niketan, Mount Mary Road, Bandra, Bombay. (Nasik-Maharashtra)	28.5.84 (NU)	Winchester disc drives	5000 units
Machinery Manufacturers Corporation Ltd Gateway Building, Apollo Bunder, Bombay. (24 Parganas-West Bengal)	28.5.84 (SE)	Floppy disc drives (capacity after expn.)	3000 nos
The National Radio & Electronics Co. Ltd Mahakali Road, Chakala, Andheri (East) Bombay. (Nasik-Maharashtra)	29.5.84 (NA)	Statistical multipexers/data network systems (other than for telecommunication purposes)	Rs 20 million

(1)	(2)	(3)	(4)
Rajeev Arora 201 Embassy Centre, Nariman Point, Bombay (Pune-Maharashtra)	29 5 84 (NU)	1. Printed circuit boards (PCB) single sided using phenolic and glass epoxy laminates; with or without tin coating solder masked, legend printed.	25,000 sq. mt.
		2. Double sided glass epoxy copper clad PCBs with and without through hole plating; tin coated or gold plated, solder masked, legend printed.	5000 sq. mt.
The Orissa State Electronics Development Corporation Ltd 289 Sahidnagar, Bhubaneshwar (Bhubaneshwar-Orissa)	30.5.84 (NU)	Pushbutton telephones	200,000 nos.

LETTERS OF INTENT CANCELLED

Om Prakash Shyamsunder Aggarwal, A/2 Elite Flats, Shahibaug, Ahmedabad (Gujarat)	12 7.82	Video cassettes recorders with monitors.
Karnataka State Electronics Dev. Corp Ltd Bangalore (Karnataka)	19 12.80	Telephone instruments

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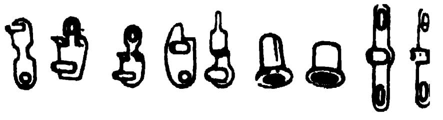

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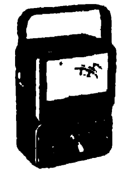

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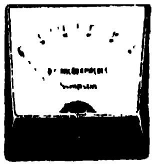

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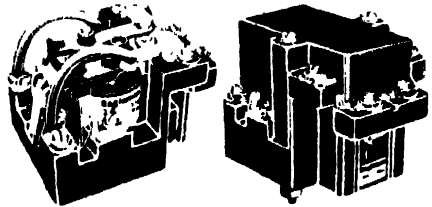

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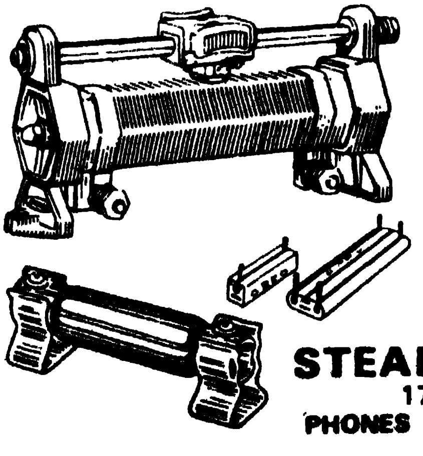

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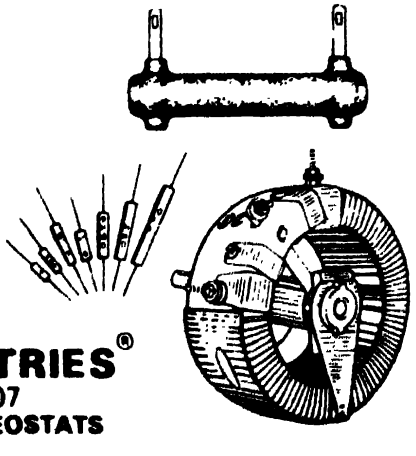

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5	FM Receiver (Personal)	15	12[illegible]
6	FM + TV Tuner	15	225
7	Cordless Radio Receiver	8	
8	BEL TV mark I II III & IV	65	
9	BEL CA 810/TBA 810 Tape Recorder	8	11[illegible]
10	BEL 700 IC Tape Recorder	5	12[illegible]
11	BEL CA 810 IC Audio Amp	5	6[illegible]
12	TBA 810 IC 7 Watts Audio Amp	[illegible]	[illegible]
13	TDA 1010 IC 10 Watts Audio Amp	4	7
14	TDA 2020 Twenty Watts Stereo Amplifier	8	20[illegible]
15	7 + 7 Watts Stereo Amp (TBA 810 module)	16	225
16	Philips 15/25 W Power Amp	[illegible]	175
17	Philips 40 W Power Amp	5	175
18	Philips 40 + 40 W Stereo with Universal preamp Left & Right	25	525
[illegible]	[illegible] + 30 W Stereo Amp IC STK 439	20	
20	Twin 40W Power Amp	10	1[illegible]
[illegible]	50 + 50 W Stereo or 100 W Mono Power Amp	15	
[illegible]	Hi-fi 100 W Power Amp	20	
23	Philips Universal preamp L & R	13	20[illegible]
24	Stereo Head preamp LM 741 382/387	5	6[illegible]
25	LM 382 Universal preamp & tone control	12	1[illegible]
26	LM 741 Universal preamp & tone control	12	1[illegible]
27	Active tone control and preamp	[illegible]	1[illegible]
28	LM 741 tone control with bass treble & presence (Stereo)	7	10[illegible]
29	Noise & rumble filter (stereo)	10	10[illegible]
30	Graphic equalizer (stereo)	15	20[illegible]
31	TBA 810 with Bass Treble & volume	7	[illegible]
32	Stereo cassette player	15	20[illegible]
33	LM 1818 Stereo Tape deck	25	6[illegible]
34	Telectron (B&W) TV	60	110[illegible]
35	2 Transistor Head preamp Stereo	6	[illegible]
36	Transistorised playback & recording stereo	15	-
37	Audio Level indicator 9 LEDs	6	9[illegible]
38	Electronic Crossover net work	10	
39	Digital clock mark [illegible] (FND 500)	10	[illegible]
40	Digital clock mark [illegible] LED	32	42[illegible]
41	Analog Clock	20	10[illegible]
42	Small Display for clocks	5	
43	Electronic Timer with Alarm	5	
[illegible]	TV Booster	[illegible]	125
[illegible]	TV Pattern Generator	1[illegible]	
[illegible]	TV Games (4 games) build your own TV	15	
48	Disco light with Musical input 3 × 150 W	25	
49	Musical Door bell	6	65
50	Electronic Horn for car	5	[illegible]
51	Music colour chaser	8	
52	Walkman Disco light	2	[illegible]
53	IC Disco light star figure	[illegible]	[illegible]
54	Mosquitto Reppeller	3	35
55	Light Dimmer	[illegible]	[illegible]
56	Emergency light	10	--
57	Two Station Versatile intercom	5	
58	Automatic Voltage stabilizer (KIT with Relay)	6	110
59	Electronic Regulator for fan	5	
60	Digital combination lock for cars	4	
61	Water level Indicator	[illegible]	
62	IC Power supply	6	
63	Battery Eliminator or Tag PCB	1	3[illegible]
64	Instant PCB available in 12 modules	12	

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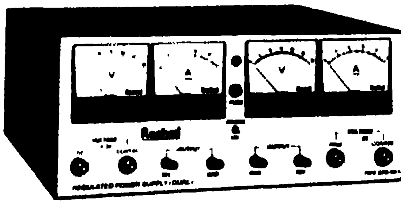

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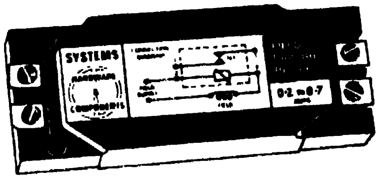

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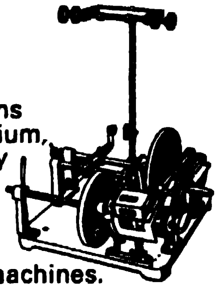

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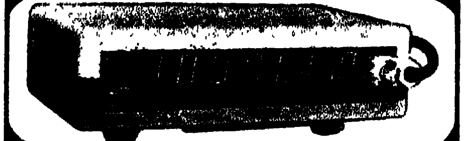

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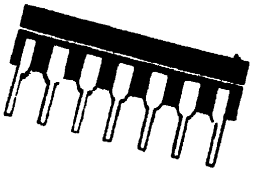

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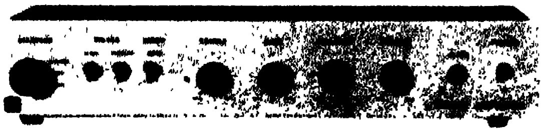

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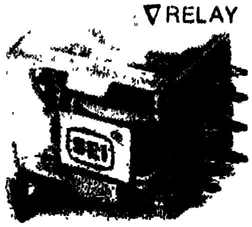

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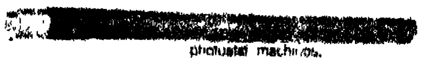

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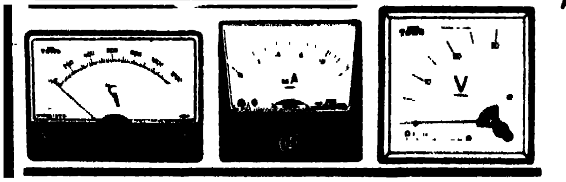

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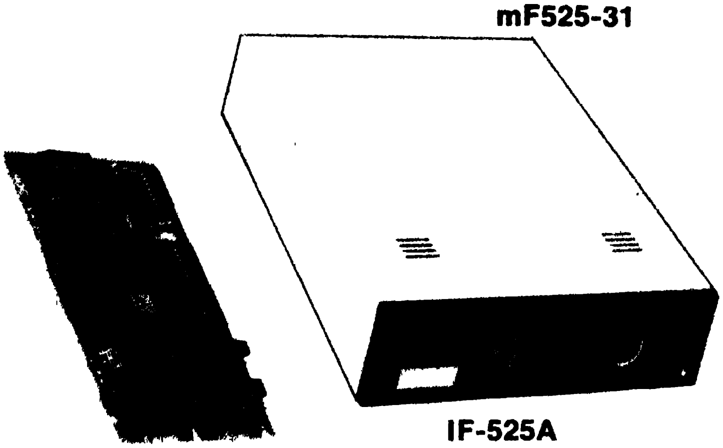

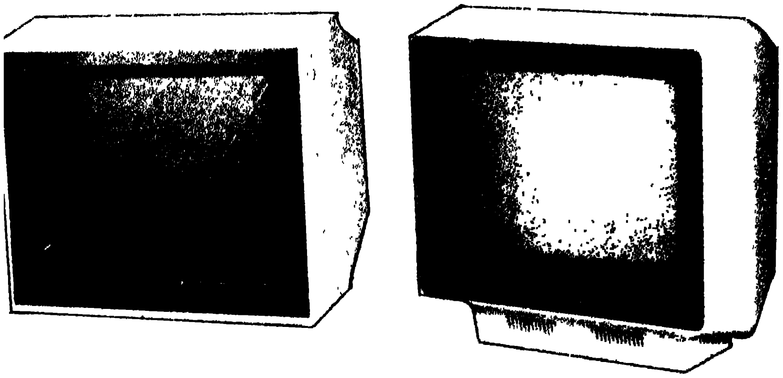

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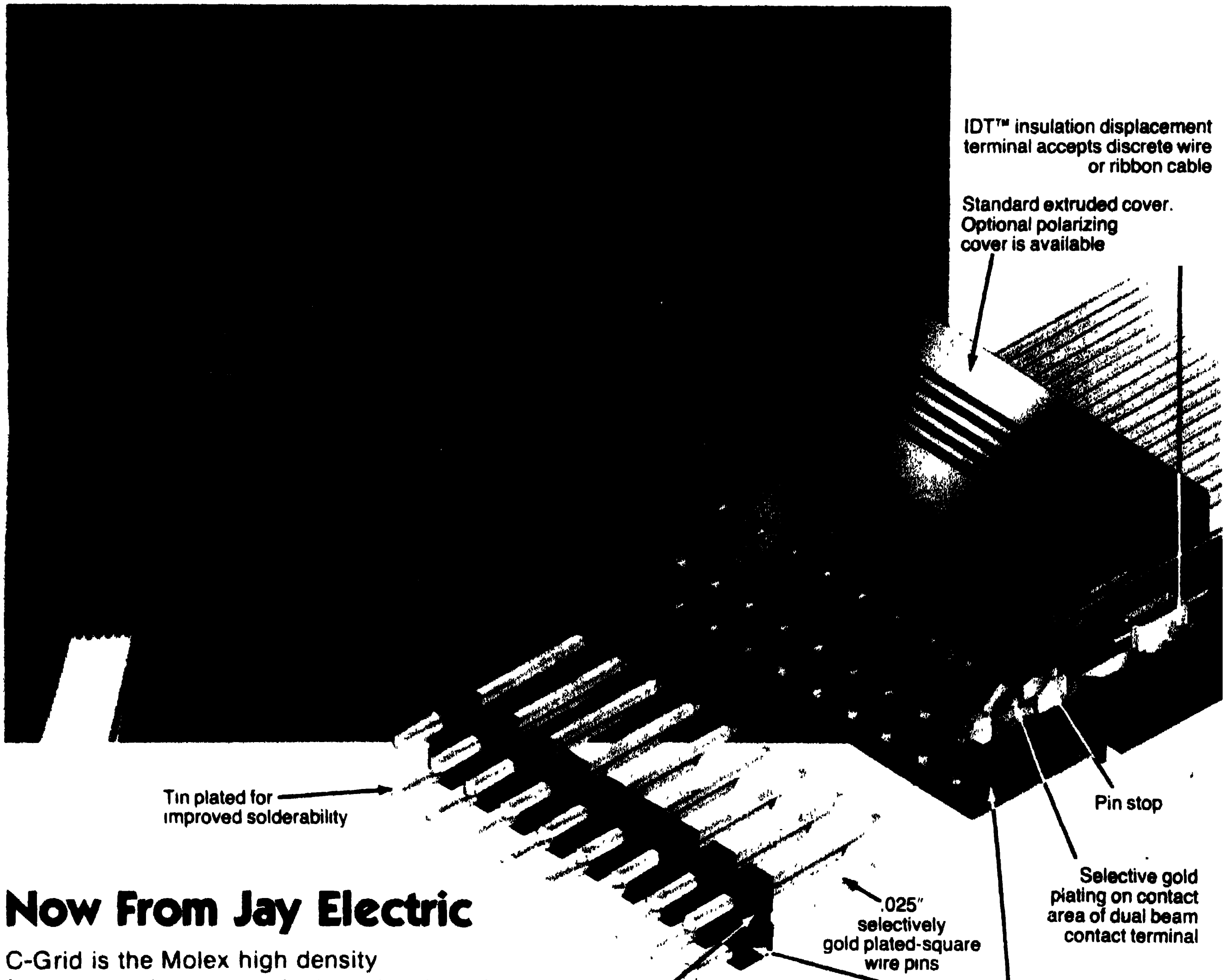
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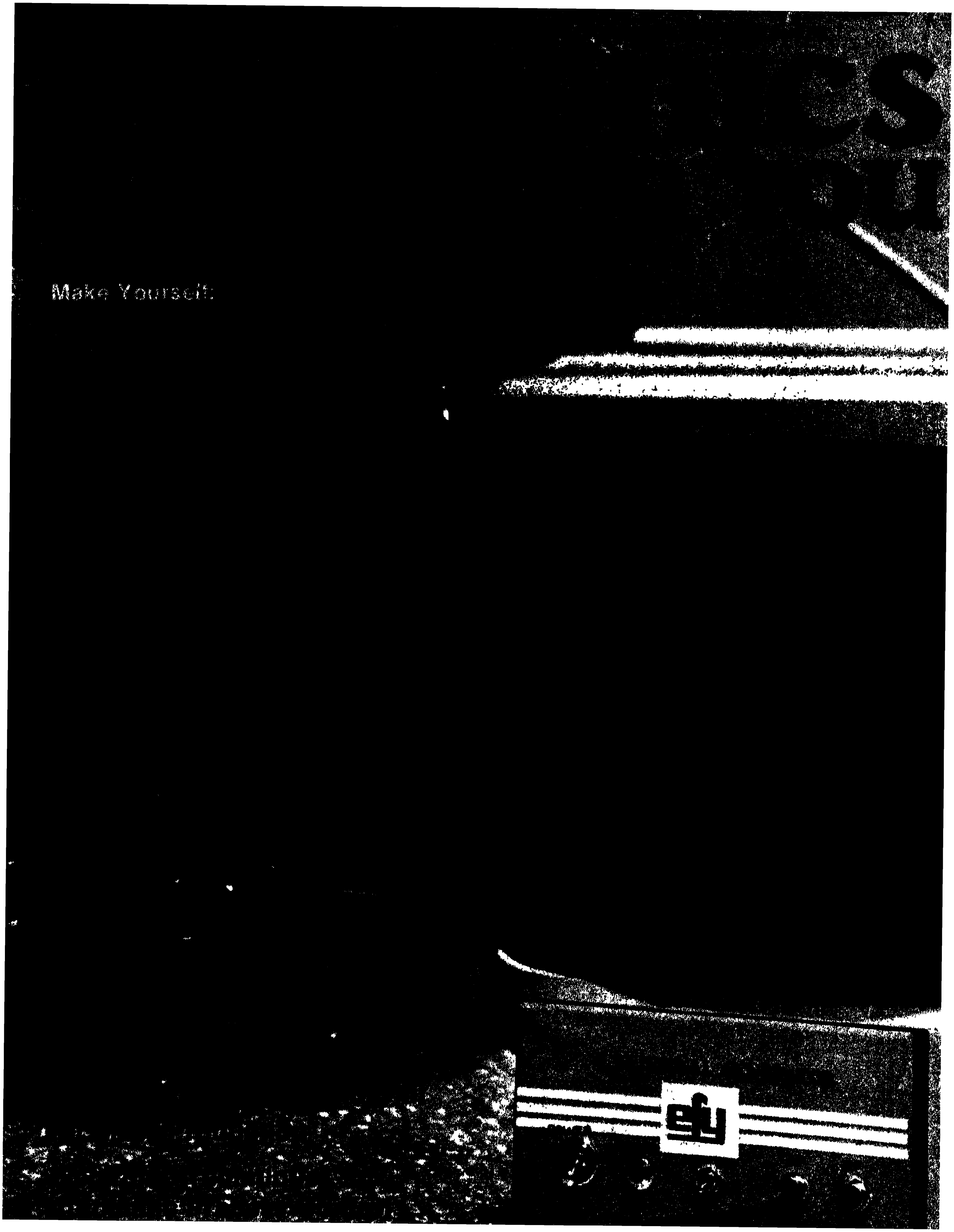

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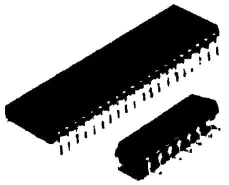

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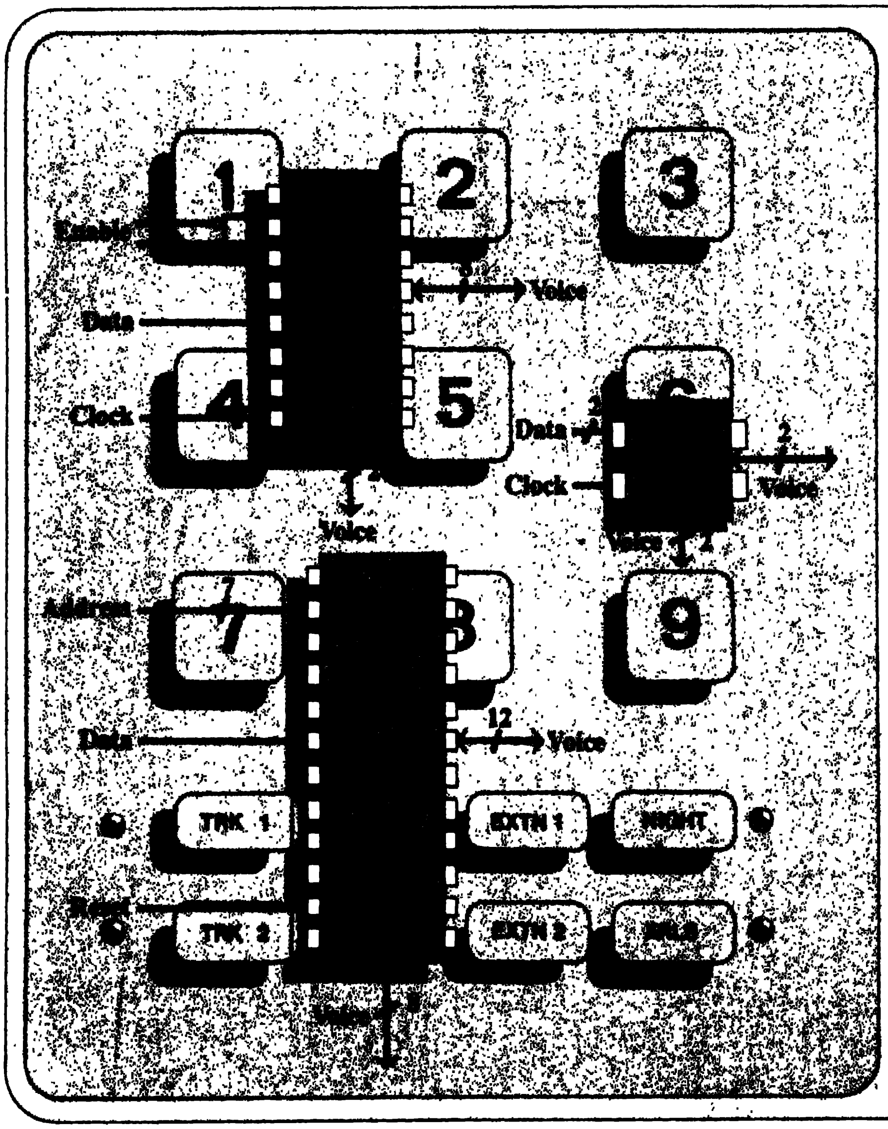

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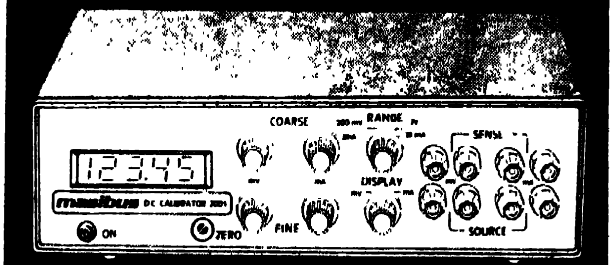

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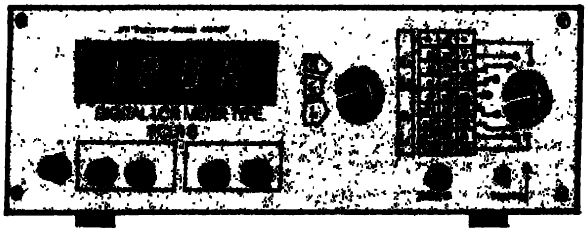

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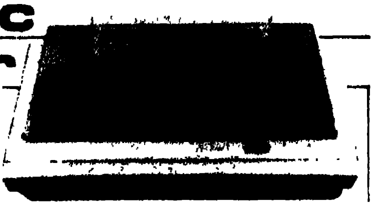

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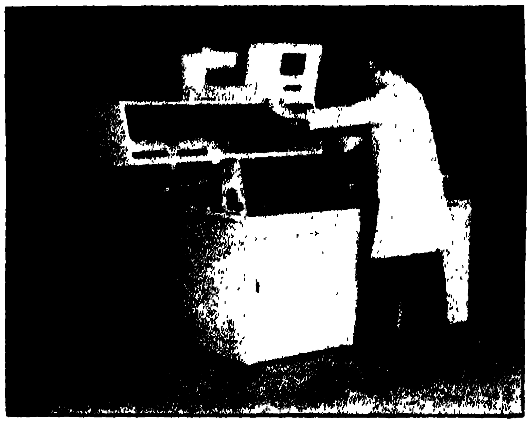

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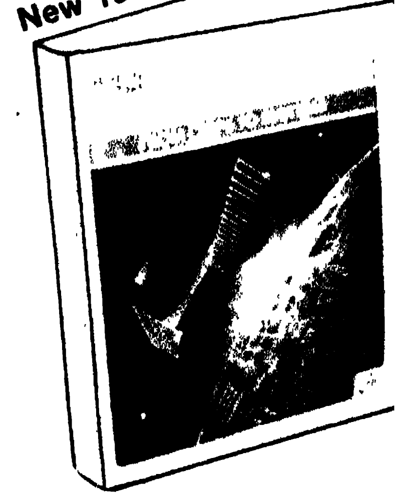

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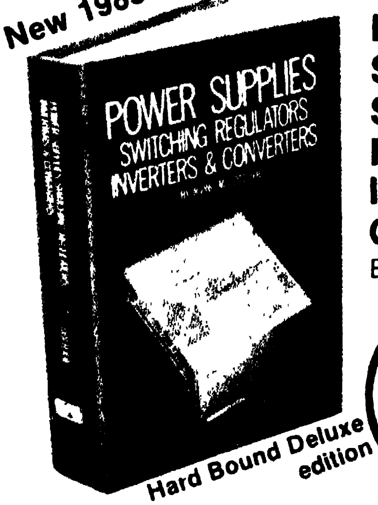

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FM Signal Generator

The alignment of a radio receiver is the most essential process required for perfect reception and reproduction of a signal to be received. Since the sound section of a TV receiver comprises a number of 'LC' tuned circuits, it also requires alignment. The FM signal generator described here enables the hobbyist to do this easily and perfectly. The generator can also be used for testing additional areas of applications discussed in the project

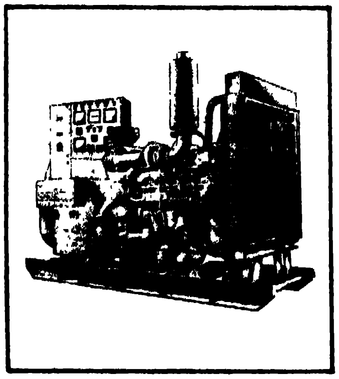
Arup Kumar Sen

27

Electromagnetic Interferences on Power Lines

Interferences, the most common cause of malfunction in the electronic system, can impair correct operation, render operation impossible or even destroy the equipment. Electromagnetic interferences present on the power lines are most crucial and are frequently encountered. Isolation transformers, chokes, filters and suppressant tubes used to overcome such interferences are discussed here in detail

H J. Zala.



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Semi-Automatic Remote Control of Diesel Generator

Normally, the diesel generator of a radio station is installed at a place far off from the control room. In case of power failure, it is a laborious and time consuming process to switch it on or off. In order to eliminate the delay in switching the diesel generator on or off and to reduce the wastage of fuel and time, here is a semi-automatic remote control for the generator which is extremely effective.

K.A. Shaikh

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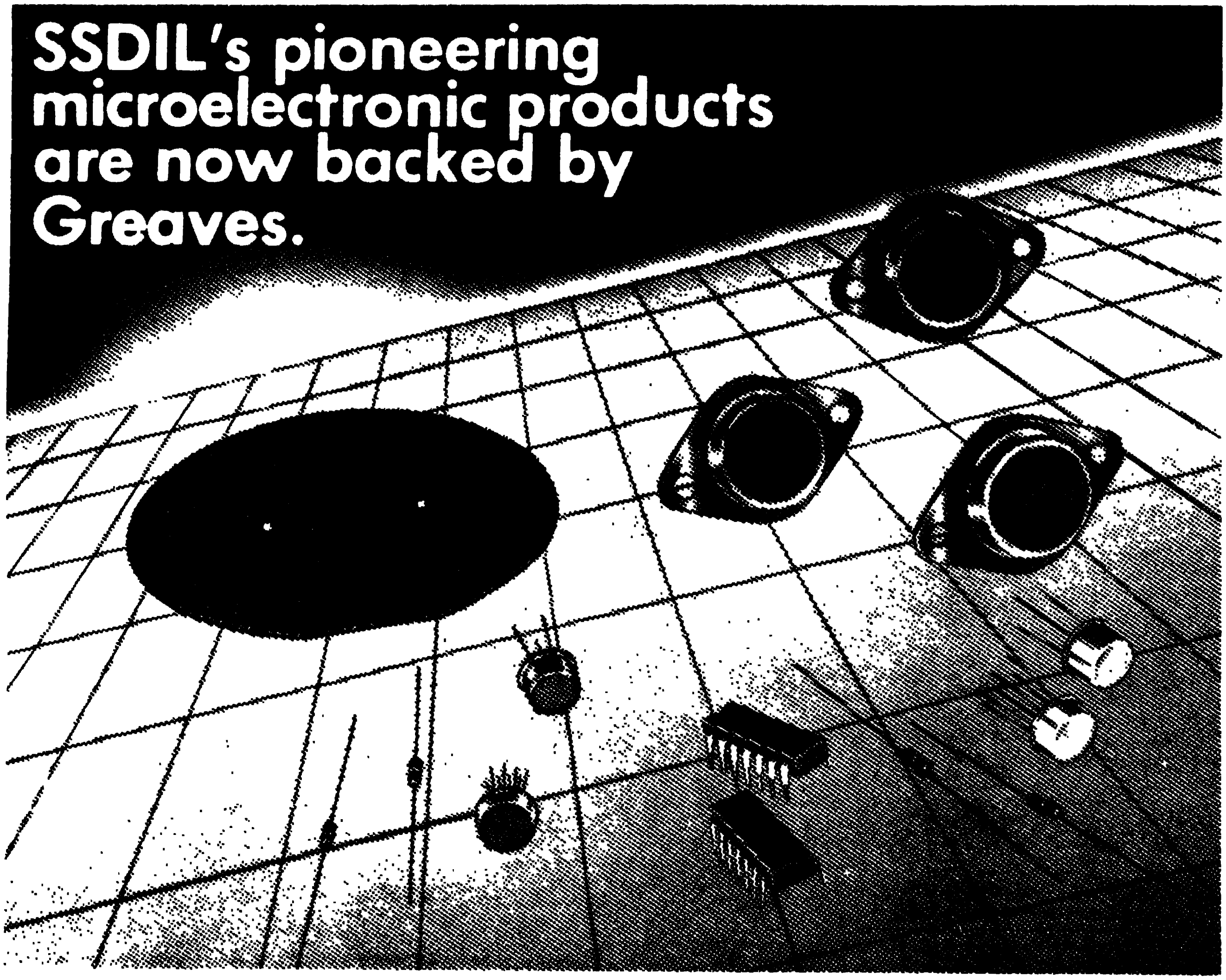

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Letters

Hourly Chime

Regarding Hourly Chime for Digital Clock article in May '85 issue. (a) can I use 1Hz output of 5387 IC (colon display) instead of IC4, and (b) can this circuit be used for alarm? If so, how?

AMARJEET SINGH BAJWA
Kapurthala

❑ It may please be pointed out to other readers that pin 2 of 7805 should be connected to ground, otherwise the chime would not work In the circuit diagram the elements of 7408 (Quad 2 input AND gate) have been drawn as NAND gate. This may lead to confusion The use of R14 (1.5k) is probably not essential Though included in the parts list, C5 (0.22μF) has not been shown in the circuit or in the component layout

In the component layout, collector and emitter of T1 have been wrongly marked Capacitors C5, C10 and C11 have not been shown in the layout One of the speaker connections has not been shown properly.

Readers may try the resistors 1k, 2.2k, 3.9k and 8.2k for R16, R17, R18 and R15 respectively Those who require more volume from the chime may refer to May '84 issue of EFY (p 11) and use a 1k resistor and SL100 transistor for driving the speaker.

Transistors BC147 have been shown in the circuit and in the parts list But CIL147, which is probably equivalent, ha been shown in the layout The readers may use either of them.

J N. RAY
Calcutta

❑ Let me offer some alternatives which I hope will provide useful stimulation to further thinking on this subject.

The sketch below shows the schematics of the ideas, the original circuit of chime can remain as published—except for the wiring of the reset terminals of ICs 4, 5 and 6. For deriving hourly pulses, the decoder suggested by me utilises the fact that in a digital clock the display indicating tens of minutes has segments b and e both off at the display of '5'. One of them or both are high in all other cases As such at the striking of an hour when the minutes change from '59' to '00', the 'b OR e' becomes high and this can supply a negative going pulse each hour For this purpose a simple decoder consisting of two diodes, one transistor, four resistances and a capacitor is suggested, which is self-explanatory

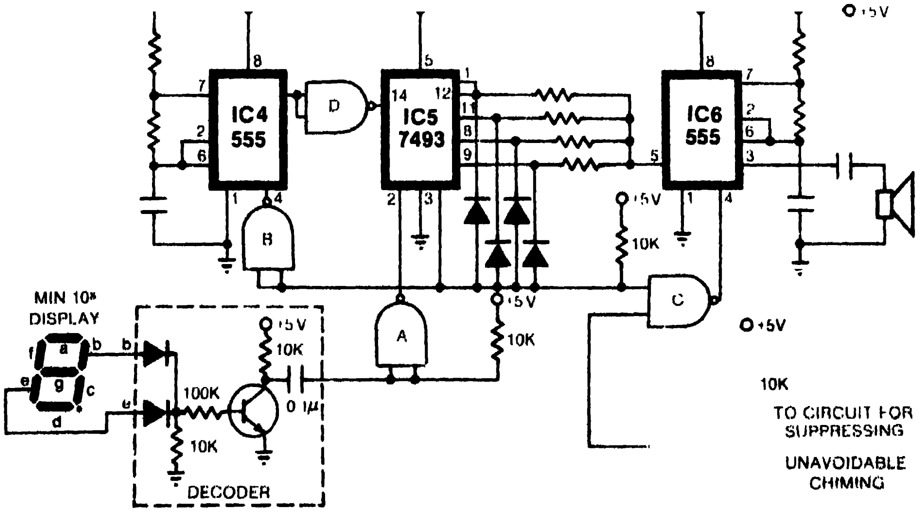
Now unless one plans to have more than one cycle of 7493 for hour striking chimes, the facility of built-in reset terminals of the various ICs can be utilised for controlling the chiming The 7493 (IC5) resets when both its reset terminals (pins 2 and 3) are brought to high and will start counting only when one of these is brought to ground

In the proposed circuit the reset terminal of 7493 (pin 3) is wired in such a way that when the counter reaches the count of (binary) 1111 (i e when all the outputs of IC5 are high) pin 3 becomes high, in all other cases it is pulled low by appropriate (low) output and diode Also, when pin 3 (of IC5) is high, the ICs 4 and 6 are disabled by NAND gates B and C wired as NOT gates by bringing down the terminals numbered 4 of these ICs (4 and 6) to ground When pin 3 of IC5 is low, the ICs 4 and 6 are enabled and the chime works as in the original circuit, and when the output of IC5 reaches the count of (binary) 1111, pin 3 (of IC5) goes high and the chime stops on account of ICs 4 and 6 becoming disabled by their low going reset terminals, and the input to NAND gate D (wired as NOT gate) becomes low making its output high. This gate D helps in maintaining the output of IC5 as this IC is triggered by falling edge only and a high-going pin 14 of IC5 does not matter This steady state (i e ICs 4 and 6 reset and IC5 parked at count 1111) will be maintained till the next hourly negative going pulse is received at the input of NAND gate A, bringing down to earth the pin no 2 of IC5 momentarily.

As the (reset) pin no 3 of IC5 was already high and pin 2 also becomes high (even though momentarily) the IC5 resets to the binary output of '0000 The chime starts working and once again stops when the output of IC5 reaches the binary count of 1111 waiting for the next hourly pulse to operate it

The unused input terminal of NAND gate C is to be used for suppressing chiming during displaying of alarm, seconds, sleep etc. The detailed circuit cannot be included here for shortage of space

P V SINGH
Bhilai

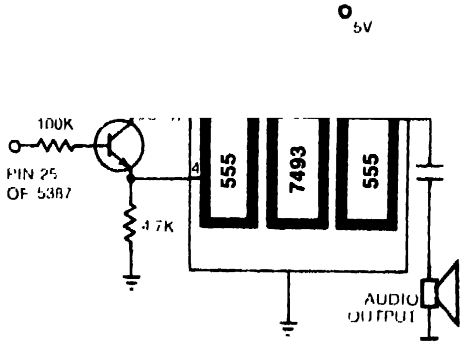


The author, Mr A. Kadarkari, replies: Regarding Mr Bajwa's letter, 1Hz output of the clock IC 5387 cannot be used as such. Proper voltage and current translators are required The requirements are listed below:

MOS IC5387 (Vcc 12V)		**TTL IC7493**	
V_{OH}	9V	V_{IH} ≤	5.5V
I_{OH}	10μA	I_{IH}	80μA
V_{OL}	$1V_{max}$	V_{IL} ≤	0.8V
I_{OL}	-24mA	I_{IL}	-1.6mA

So inbetween these two ICs a 9V to 5.5V translator cum buffer (MOS to TTL interface) should be provided to meet the 7493 clock input requirements. Moreover, in the published circuit, to get the flexibility of changing the tone rate according to one's taste, a separate oscillator was used

My circuit will give sixteen different tones for every hour It can be used as a pleasing alarm if properly interfaced with the alarm output pin (25) of 5387 The circuit given below may be used:



The mistakes pointed out by Mr J N Ray—like pin 2 of 7805 not being grounded, 7408 drawn as NAND gate etc are all correct and may please be corrected

The resistance (pull up resistance) R14 (1.5k) is essentially required Otherwise, the driver transistor SL100 won't get saturated. This in turn won't supply adequate power to the chime circuit to operate

I appreciate Mr P.V. Singh's, interesting idea This is one of the possible ways to get the decoded pulse for the hourly strobing signal. It may work The readers may construct, test and make use of this

---

Letters to the Editor can be sent to:

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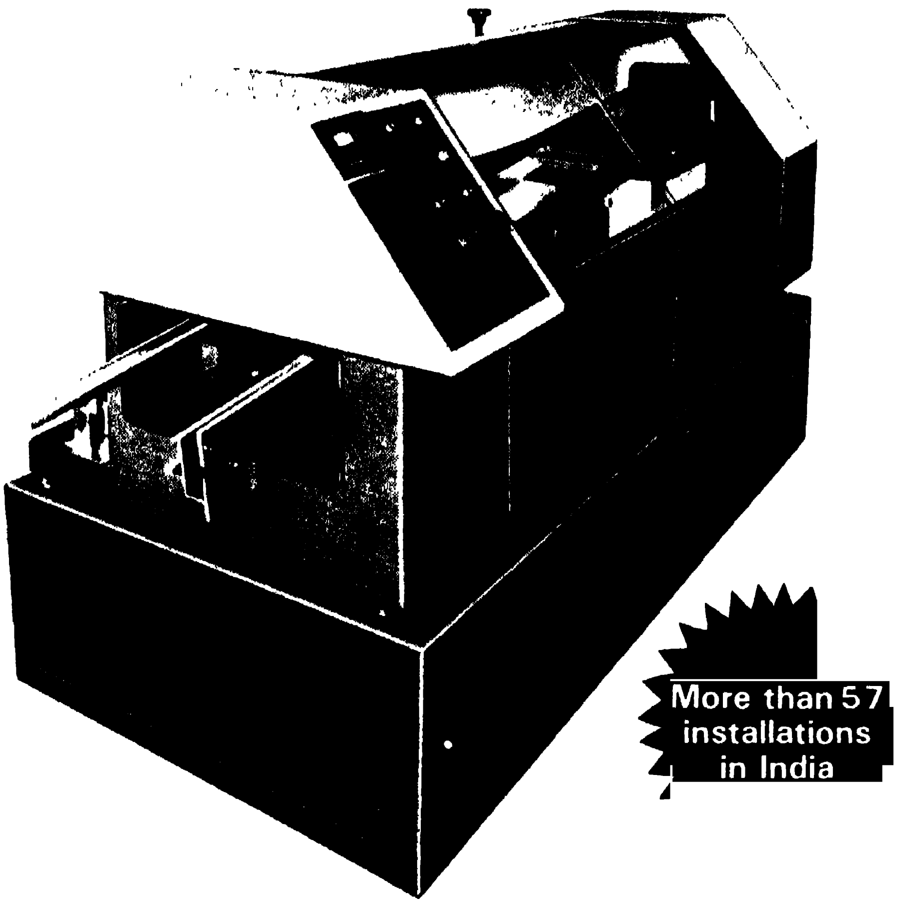

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.What's New.

IN INDIA....

Government recognises Hartron R&D centre

The Ministry of Science & Technology has recently recognised HARTRON's project in Ambala—the Instruments Design Development and Facilities Centre—as an R&D laboratory.

During last three years, the centre has built excellent facilities in the form of sophisticated equipment worth about US $ 1 million, services of 25 engineers and 4 foreign experts. As a result of this recognition, the centre will now be able to take up more advanced research projects from the industry and public sector organisations and also would be in a position to import equipment without paying custom duties etc.

The centre is also entering the international scene by acquiring technical cooperation with a similar institute in Sofia, Bulgaria under UN aid. The proposed project will enhance the technical capabilities of the Ambala centre in the area of microcomputer systems and process control instrumentation and of Sofia Institute in the area of optical and laser techniques.

The centre has built an excellent rapport with the industry and is already catering to about 350 units. At the request of industry, the centre has developed 30 numbers of prototypes of different types of instruments for regular production. Currently sponsored projects of sophisticated nature are coming from several prestigious organisations in the country like ISRO. The services of the centre include design and development, test and calibration, production debugging, and training of technical staff of industry in the field of instrumentation.

DoE concessions for electronic typewriters

The Department of Electronics (DoE) has decided to provide concessional duty, excise exemption and other concessions available to the computer industry to the manufacturers of electronic typewriters if there is a memory feature in the product, can be programmed and has a RS 232C port or equivalent interface for computers.

This step has been prompted by the fact that the manufacturing and development base for electronic typewriters is identical to that of computer terminals and can be considered as a single product from the manufacturing point of view if the above conditions are satisfied.

The bunching together of typewriters—manual, electric and electronic—with computer terminals under the same broadband licensing would help increase the volume of production and applying economies of scale. The necessary bulk purchase of components involved is also expected to reduce the cost of electronic typewriters considerably

Pricing of ET&T canalised TV tubes

The prices of black-and-white and colour picture tubes sold by Electronics Trade and Technology Development Corporation Ltd (ET&T) during the period April 1984 to March 1985 are given in Table 1.

These prices were ex-port of entry (Bombay/Madras).

Prices were fixed from time to time depending on exchange rates ruling and broadly consist of.

1 CIF costs depending on FOB cost and port of shipment from different suppliers
2 Customs duty at the rate of 75 per cent
3. Expenses incurred in the course of import dependent upon 1 and 2. above.
4. ET&T service charges at the rate of Rs 20 per B&W tube and Rs 35 per colour picture tube.

The selling prices were fixed as advised by the Pricing Committee headed by CCI&E.

New Elcina committee

At a meeting held in New Delhi recently, the Electronic Component Industries Association (ELCINA) has elected its new executive committee for 1985-86, headed by Mr J.S. Monga, managing director of Bolton Private Limited, Faridabad. Mr Monga has been on the ELCINA committee for a number of years and was its vice-president last year.

The other office bearers are Mr S.P. Kotwal (vice-president), Mr D.V.S. Raju (vice-president), Mr Sanjiv Narayan (hony secretary) and Mr A.J. Devapragasam (hony treasurer).

IMTEX-86

The Sixth All India Machine Tool Exhibition (IMTEX-86) is being organised by the Indian Machine Tool Manufacturers' Association (IMTMA) at Bombay from February 6-17, 1986.

IMTEX-86 will aim at projecting the capability of Indian machine tool industry through the display of the entire range of machine tool products made in the country It will provide opportunities

Table I

Black and white		
51 cm size.	April 84 to October, 84	Rs 390.00
	Nov., 84 to March 85	Rs 460 00
36 cm size	April 84 to Nov , 84	Rs 232.00
	Dec., 84 to March, 85	Rs 275.00
31 cm size.	April 84 to Dec , 84	Rs 200.00
	Dec , 84 to March, 85	Rs 245.00
Colour		
1.4.84 to 31 7.84	Rs 1403 Gold Star with DY	
	Rs 1487 Toshiba with DY	
	Rs 1415 Toshiba without DY	
	Rs 1147 Samsung without DY	
1.8.84 to 31.1 85	Rs 1540 CPT with DY	
	Rs 1495 Toshiba without DY	
	Rs 1306 Samsung without DY	
1.2 85 to 31 3 85	Rs 1638 CPT with DY	
	Rs 1577 Toshiba without DY	
	Rs 1404 Samsung without DY	

DY: Deflection Yoke

for a closer interaction between machine tool manufacturers and various user sectors

The display at IMTEX-86 will reflect latest technology trends in the areas of NC/CNC, CAD/CAM, EDM and ECM machines etc. The exhibition will thus symbolise the technological development of the industry and its growing market potential

Considerable interest has been shown by many foreign machine tool companies, specially those from industrially advanced countries, in participating in the IMTEX-86 exhibition Their participation may lead to new technical collaboration arrangements for the manufacture of high technology machine tools in India Further details can be obtained from IMTMA, 82 Jolly Maker Chambers II, 225 Nariman Point, Bombay 400021.

Annual convention of CSI

The Computer Society of India will be holding its 21st Annual Convention—CSI '86 in Calcutta next year. Commencing on January 22, the four day convention will be attended by about 2000 delegates from India and abroad

Experts including those from outside India are expected to address the convention and throw light on the convention's theme 'Computer for Productivity and Quality'.

Further details can be obtained from Mr P.B. Ghosh, Chairman, Organising Committee CSI '86, The Calcutta Electric Supply Corpn (I) Ltd, Victoria House, Calcutta 700001.

Indigenous production of TV picture tubes

Black-and-white picture tubes are being manufactured by several units in the country The names of the units together with the quantities/types of tubes produced by each unit during 1984 is as given in Table II

Table II

Name of the Company	*Quantity*
Bharat Electronics Ltd, Bangalore.	244,000 (51 cm)
Punjab Display Devices Limited, Chandigarh.	23,836 (51 cm)
Samtel (I) Limited, Bhiwadi	(i) 37,673 (31 cm)
	(ii) 27,918 (36 cm)
	(iii) 266,176 (51 cm)
Teletube Pvt Ltd, Ghaziabad.	189,826 (51 cm)
Uptron Anand, Kanpur	12,012 (51 cm)
WEBEL Video Devices Limited, Calcutta	(i) 12,246 (51 cm)
	(ii) 845 (60 cm)

Black-and-white picture tubes are being sold by these companies directly to TV manufacturers. Till the recent import policy for 1985-86, the import of black-and-white picture tubes was canalised through Electronics Trade & Technology Development Corporation (ET&T)

While steps are continuously being taken to meet maximum requirements through indigenous sources and indigenous production, the shortfalls would be met through imports directly by TV manufacturers. At present there is no production of colour picture tubes in the country

Scope to set up data bank

The Standing Conference of Public Enterprises (SCOPE), the apex body of all central public sector undertakings, plans to set up a computerised data bank on all public sector units to improve their functioning.

The establishment of this facility is expected to help the government in formulating fiscal and economic policies and aid these undertakings in implementing them effectively. The project is slated to begin operation in a year's time

New MD for Meltron

Mr Bishambar N. Makhija, IAS has recently taken over as managing director of Maharashtra Electronics Corporation Ltd (MELTRON). Mr Makhija has done his education at Delhi University and after taking his master's degree in commerce, has done his MBA from USA.

Prior to this assignment, Mr Makhija was administrator in the Municipal Corporation at Nagpur. He was also the development commissioner, SEEPZ (Santacruz Electronics Export Processing Zone), Bombay for about five years from 1978 to 1983.

.AND ABROAD

A computer on hand

The CS21 is a hand-held microcomputer specially designed and fully certified for use in hazardous conditions in mines, paint stores, petro-chemical installations and oil rigs

Developed in Scotland, the CS21 acts as a notepad, portable data capture unit, work study terminal, calculator, calendar, stopwatch and electronic tape recorder Versatile as a desk-top computer, the CS21 can withstand the rigorous environment of coalface conditions. The unit can be supplied with a maximum of 128k memory and can be programmed in computer assembly language to suit a particular application; it can also be equipped with basic language to allow programs to be written by the user.

A keyboard with 'click effect' keys and two liquid crystal displays are housed in a plastic case sealed from moisture and dirt The keyboard has 31 keys providing 61 functions via a full set of alphanumeric keys and additional symbol/function keys. There are two liquid crystal

Hand-held microcomputer for hazardous areas like oil rigs displays, one with two lines of 24 characters, the other with two lines of 16 characters enabling the top display to be used for giving the operator instructions and the bottom display for showing the information as it is entered.

The unit is fitted with a socket that allows connection to a desk top computer via a suitable interface while a small auxiliary battery maintains the contents of the memory when the CS21 is switched off or, when the mains battery packs runs down or is removed.

Science Expo in Japan

The International Exposition, Tsukuba 1985, which opened on March 17, 1985 near Tsukuba Science city in Japan, is a six-month science fair sponsored by the Japanese government which will run through September 16

Though the main purpose of the exposition is to promote advanced technology, this is done in a manner which allows this technology to be enjoyed and appreciated by children and adults alike. The theme of the Expo '85 is 'Dwellings and Surroundings—Science and Technology for Man at Home', though several exhibits deal with outer space. Visitors get a chance here to look down on earth from weather satellites, rockets and futuristic space stations.

A total of 48 countries, 37 international organisations, and several local and foreign corporations are participating in the event expected to draw 20 million visitors during its six-month run.

Digital television studios

Significant progress was made in establishing international standards for future digital television studio systems at a meeting of a CCIR (International Radio Consultative Committee) working party, an organ of the ITU, held recently in Tokyo when new draft standards both for bit-parallel and for bit-serial video signal interfaces, defining the interconnections between items of digital television equipment were agreed upon

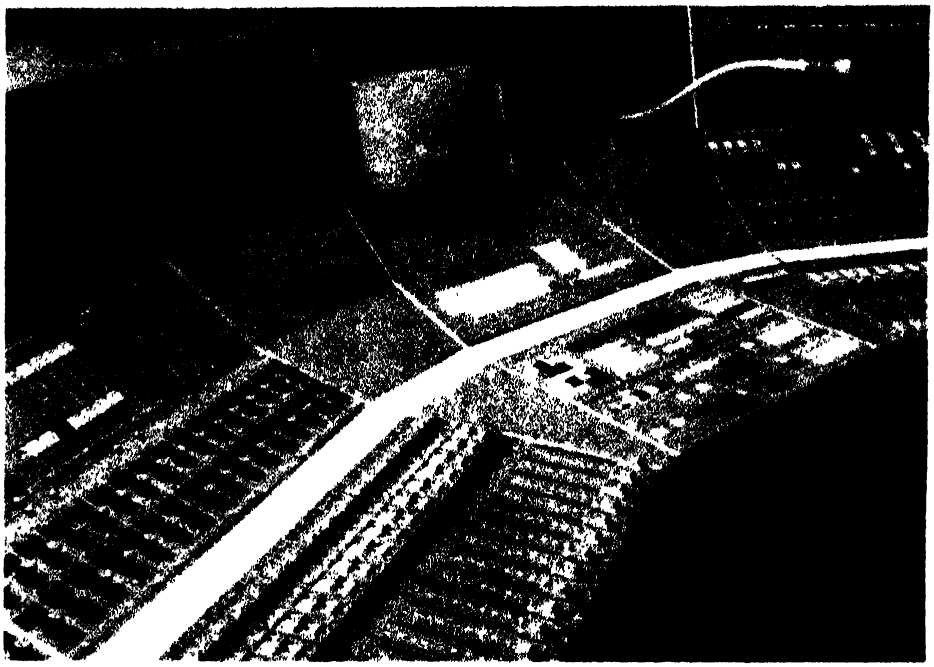
When published as CCIR recommendations, these standards will enable manufacturers, broadcasting organisations and production houses to proceed confidently with digital television equipment design and installation.

Sound-mixing system

The world's first all-digital sound-mixing system to be sold outside the United Kingdom is to be supplied by Cambridge-based Neve Electronics to the major German radio network WDR (Westdeutscher Rundfunk).

Neve's digital sound mixer has been specified by WDR for installation in the concert hall of a new cultural centre being built by the city of Cologne The equipment will make it the world's first concert hall equipped to make digital recordings of live broadcasts.

The WDR contract includes the provision of fibre-optic transmission of digitised microphone signals from the stage to the mixer, enabling fully digital multitrack mastering and broadcast to take place.



The Neve DSP desk at the CTS Studios, London

Arusha meet on world telecom development

A World Telecommunications Development Conference held in Arusha (Tanzania) recently was aimed at studying and exchanging views on the many aspects of the report, 'The Missing Link' of the independent commission for worldwide telecommunications development, that has national government policy implications.

Delegations from 93 countries, members of the International Telecommunication Union (ITU), and representatives from many international and regional organisations, took part in the conference. The conference elected four vice-chairmen from different regions of the world, including Mr Ram Niwas Mirdha, minister of Communications for the Asia-Pacific region.

AFCEA Korean conference

The AFCEA Asia-Pacific Conference and Exposition to be held on September 17-19, 1985 at Seoul, South Korea will have 'Dual Use Technologies for Global Communications and Information Processing' as its theme.

Sponsored by the AFCEA, this professional conference and exposition will provide a latest update in communications and electronics technology—monitoring the newest computer, fibre optic and satellite applications and technologies. The advances in the state-of-the-art, high technology will also be displayed at the exposition.

Detailed information on the conference can be obtained from AFCEA Asia-Pacific Conference, Y D. Lee, Yoido, P.O. Box 231, Seoul, Korea.

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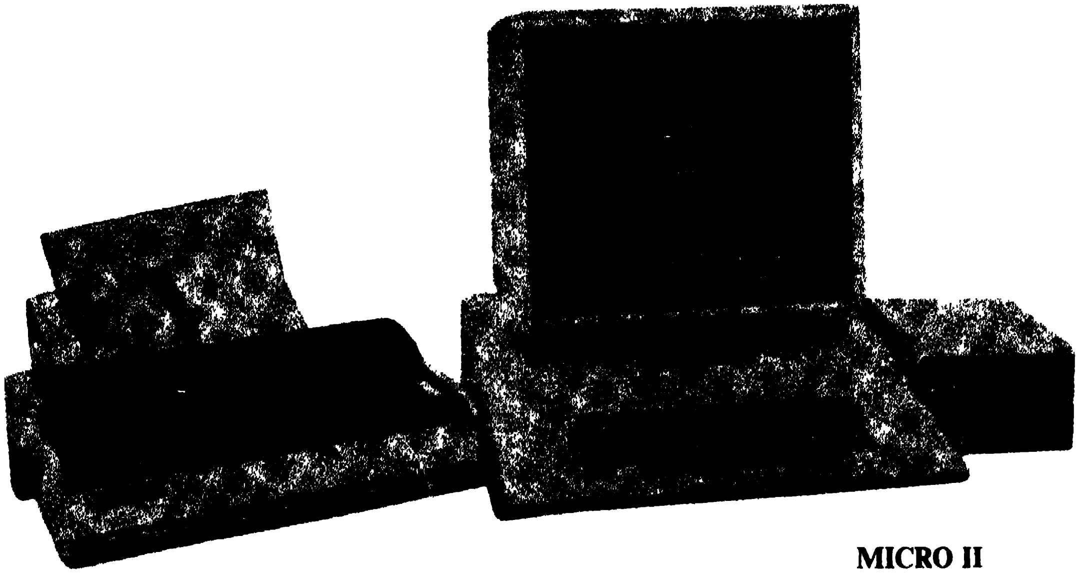

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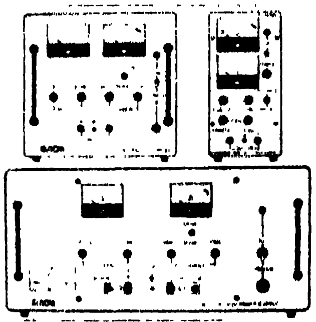
0-30V/3A	242×221×315	Rs 2020/	Regulation	
0-30V/5A	242×221×315	Rs 2990/	Ripple	1.0mVrms max
0-30V/10A	483×221×310	Rs 3790/	Protection	Overload, short Circuit, Current limit
0-15V/1A	108×221×270	Rs 1390/		settable 10% to 110%
0-15V/2A	108×221×270	Rs 1650/	Metering	Separate Voltmeter Ammeter to monitor
0-15V/5A	242×221×315	Rs 2800/-		output Voltage and Current
0-15A/10A	483×221×310	Rs 3580/		



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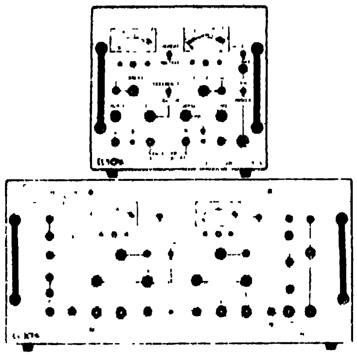

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Line & Load	±0.05%	0±30V/2A	242×221×315	Rs 2650/
Regulation		0±30V/3A	483×221×310	Rs 3650/
Ripple	1.0mVrms max	0±30V/5A	483×221×550	Rs 5350/
Tracking	Within ± 1%	0±30V/10A	483×221×600	Rs 7390/
Protection	Overload, short circuit, current	0±15V/1A	242×221×300	Rs 2350/
	limit settable 10% to 110%	0±15V/2A	242×221×300	Rs 2550/
Output	Both outputs floating, can be used in	0±15V/3A	242×221×315	Rs 2800/
	series, parallel	0±15V/5A	483×221×310	Rs 5100/
		0±15V/10A	483×221×550	Rs 6800/
Metering	Two dual scale meters to monitor			
	output voltage & current			

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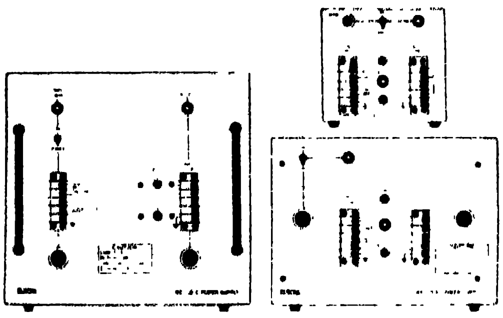
5V/3A	150×125×230	Rs 990/	Line & Load	
5V/5A	150×125×230	Rs. 1050/	Regulation	±0.05%
5V/10A	215×155×250	Rs 1680/	Ripple	1.0mV rms max
			Recovery time	100 μ sec
12or15V/2A	150×125×230	Rs. 860/	Protection	Overload, short circuit, current fold
12or15V/5A	150×125×230	Rs 1220		back.
12or15V/8A	242×221×315	Rs 1690/		Overvoltage crowbar, standard
12or15V/10A	242×221×315	Rs 1750/		on 5V models.
24or27V/1A	150×125×230	Rs 770/	Metering	Optional
±12or±15V/1A	150×125×230	Rs 1020/	Voltage & Current	
±12or±15V/2A	215×155×250	Rs. 1320	Adjustment	Provided on front Panel



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Electronic Techniques For Automatic Process Control

Part I

A.K. Kapila

In recent years automatic process control has assumed considerable importance in chemical industry due to complexity of modern processes, increase in plant sizes and production rates, rise in labour costs and decrease in profit margins. There is an ever-growing demand for more and better control techniques as these bring increased productivity and lower production costs, give better and uniform quality of product and greater safety to operating personnel. Electronic techniques have now taken a lead over other techniques for automatic process control because of several reasons.

Reliability. The majority of solidstate control systems available for industrial applications use specially developed semiconductor devices with lives longer than that of the equipment being controlled. Once a new control system using these assemblies has been tested and set in operation, its predictable life is completely independent of duty cycle rate. The absence of any moving parts in solidstate control systems results in completely silent operation and negligible deterioration in the functional characteristics.

Wide experience shows that semiconductor devices are liable to failure only during the initial operating period of test loading and that if a soaking test of sufficient duration is arranged before installation, extremely high reliability is assured.

Speed of response. Where fast operating times are of importance, electronic controls are a natural choice as the absence of moving parts for transferring information through a system means that delays between command and action can be insignificant. With suitable selection of components and careful designing, these delays can be reduced to total periods of a few microseconds.

Cost. With continually improving technology, unit and sub-system costs have been considerably reduced and are likely to reduce further in future. The installed costs of electronic systems are less for large plants where transmission distances are more than 100 metres. The power consumption of modern electronic controllers incorporating solidstate components is also quite low.

Accuracy. Modern electronic controllers have accuracy of ±0.25%. Digital instruments can have even better accuracy.

Maintainability. One of the most significant improvements introduced in the design of electronic controllers is the modular concept of construction. Plug-in assemblies and sub-assemblies have made replacement and repair much easier.

Packaging. There have been many recent improvements in equipment packaging. Large case instruments have been replaced by sub-miniature instruments. Not only have instrument sizes been reduced, but the density of instruments has also increased to provide much more information in a given panel area.

Computer compatibility. Electronic controllers provide convenient, economic interfacing with supervisory digital computers and data processing or data acquisition systems. This has resulted in the use of more advanced control techniques such as adaptive and optimal control.

Control fundamentals

The chemical industries have scores of differing processes. Rigid specifications for each and every product require close control of hundreds of process variables such as pressure, flow, level, temperature etc. These process variables will change unless energy or material input equals output. Thus, the main function of a process control system is to manipulate the energy or material input-to-output relationship of a process, so as to keep the process variables within desired limits.

An automatic controller is a device that measures the value of a process variable and operates to limit the deviation of that variable from the setpoint. A process variable that is held within limits is called a controlled variable. The automatic controller regulates the controlled variable by making corrections to another process variable which is called the manipulated variable.

Control techniques range greatly in complexity. Selection of a control technique to solve a particular control problem requires a detailed knowledge not only of the basic features of the various types of electronic controllers, but also of the physical and chemical characteristics of the process fluids and mechanical aspects of process equipment such as pumps, mixers, reactors, heat exchangers and the interconnecting piping system.

Process characteristics

Selection of a suitable control technique for a particular process depends on its characteristics. Every process exhibits two effects. (i) changes in the controlled variable due to altered conditions in the process, generally called load changes, and (ii) a retardation or delay in the time it takes the process variable to reach a new value when load changes occur, called the process lag. This lag is covered by one or more of the process characteristics of capacitance, resistance, and dead time.

Process load is defined as the total amount of control agent required by a process at any one time. Process load is directly related to the position of the final control element required to maintain the controlled variable at the setpoint. A load change causes deviation of the controlled variable from the desired setpoint value and requires a new position of the final control element. Both the magnitude and the rate of load change are important in selection of the control technique.

The load changes in a process are not always easy to recognise. Some of the causes of process load changes are: (i) greater or less demand for control agent by the controlled medium, (ii) change in composition of the control agent, (iii) changes in ambient conditions, and (iv) changes in process reaction rate.

The capacitance of a process is change in its capacity against some reference. In any process, a large capacitance relative to the flow of control agent may be favourable to automatic control. A large capacitance has a tendency to keep the controlled variable constant in spite of load changes. It will make it easier to hold a variable at a certain value but more difficult to change to a new value.

Although the overall effect of a large capacitance is generally favourable, it does introduce a lag between the time a change is made in the control agent and the time the controlled variable reflects the change. The corrective action brought about by an automatic controller to maintain the balance in the process depends upon the relative rate at which the process reacts.

The second basic process characteristic is resistance, defined as the opposition to flow. If a material is being heated in a process with high thermal resistance, it will take more control agent to effect a temperature change in the material than in a process with low thermal resistance.

Many processes, particularly those involving temperature control, have more than one capacitance. If the flow of energy passes from one capacitance through a resistance to another capacitance, there is a transfer lag.

Transfer lag in temperature control is always unfavourable because it limits the rate at which heat input can be made to effect the controlled temperature. The result is a tendency to overshoot the setpoint, because the effect of the addition of heat is not immediately felt and the controller calls for still more.

The lag which occurs in processes where it is necessary to

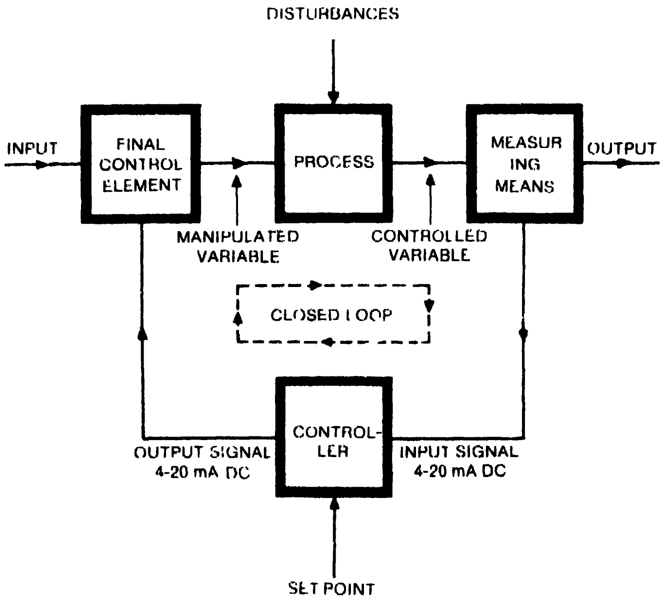

Fig. 1: Closed loop process control system.

transfer energy by means of a fluid flowing through some distance at a certain velocity is called distance/velocity lag or dead time. Dead time is often created by the installation of final control element or measurement system at a distance from the process. Dead time introduces more difficulty in automatic control than does a lag at any other point in the control system. It delays the process reaction and during this interval, the controller cannot initiate corrective action.

Automatic process control system

The function of an automatic process control system is to direct the forces that give stable plant operation by maintaining desired values of process variables. An automatic process control system is essentially a feedback closed loop control system. In closed loop control, the energy input to the system is some function of the output. This effect is commonly termed as feedback. Hence such automatic process control system is known as feedback control system.

The elements comprising a typical control system are represented by the block diagram in Fig. 1. The essential elements of a feedback closed loop system are. process, measuring means, controller and final control element.

The process is the part of the system which performs some desired function. Usually some form of energy entering the process causes the desired operation to take place.

The measuring means essentially consists of a primary sensing element and a transmission system. The primary sensing element detects the process variable to be controlled such as pressure, flow, level, temperature etc. The transmission system produces an electrical output signal, usually in the range of 4 to 20mA DC, proportional to the value of the process variable. The measuring system is usually located in the field near the process and transmits the current signal to the controller located in the control room.

The controller receives the electrical signal from the measuring system. The measuring element of the controller measures the process variable and converts it to a movement on a display device and a control unit. The display device presents the value of the measured variable to the observer.

The control unit consists of an error detector and a control amplifier. The error detector compares the value of the process variable with the desired value and produces an error signal. The error signal is then fed to a control amplifier which produces an output which is a function of the error signal and is suitable in dynamic response and magnitude to actuate the final control element. The controller output also usually lies in the range of 4 to 20mA DC.

The final control element is located in the input to the process in the field. It receives the signal from the controller and by some predetermined relationship changes the energy input to the process to exert a correcting influence on the process.

Operation of the control system

Assume that the system is operating at equilibrium conditions, that is, the controlled variable equals the setpoint value and there is no error. Now, if a load change occurs in any part of the system, the equilibrium conditions are disturbed and controlled variable changes. This change produces an error, which is detected by the error-detection mechanism of the controller.

The error signal to the control amplifier causes the controller to produce an output signal which is the result of the error. The final control element, upon receiving the signal from the controller, changes the energy flow to the process.

The altered energy flow brings the controlled variable signal back to the desired setpoint, if the system is correctly designed and operating properly. This sequence of operations repeats itself as long as there is an error.

The controller operates only when there is an error. It cannot predict future action of the control system. The purpose of the control system is to reduce the error when it occurs to zero as quickly as possible with a minimum amount of cycling.

Electronic controller

Electronic controller essentially consists of an error detector, control amplifier and RC networks. It receives a DC input current signal from the transmitter and provides a DC output current signal to the final control element. Input and output signal level is generally 4 to 20mA DC. The output current of the controller can drive a final control element up to 1.5k impedance.

The error signal is generated in an error detector (Fig. 2). The error detector essentially consists of a precision resistor of 62.5 ohms and a precision potentiometer. A zener-stabilised reference voltage of 1.25V DC is connected across the potentiometer. The input signal current of 4 to 20mA DC is passed through input precision resistor which produces a voltage signal of 0.25V to 1.25V DC.

The error detector senses the magnitude and direction of the difference between the controlled variable and the setpoint. The setpoint is adjusted by moving the pointer to the desired value along the indicating scale of the controller by a knob. This also moves the setpoint potentiometer so that a precise voltage equivalent to setpoint value is impressed across the potentiometer.

The input signal is compared with the setpoint signal and any difference is sent as an error voltage of -1V to +1V to the

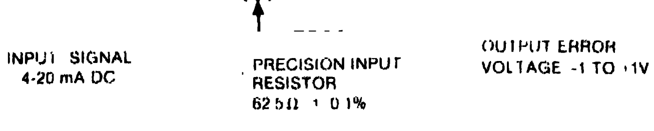

Fig. 2: Error detector circuit of the controller.

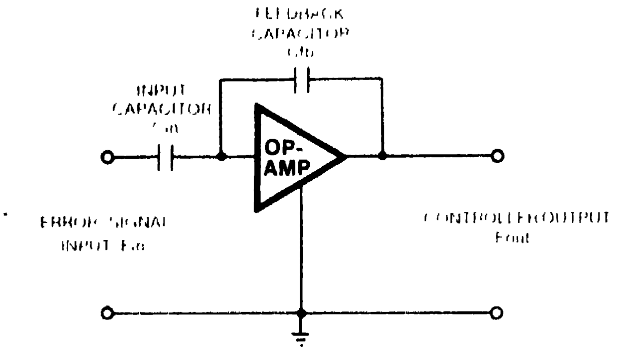

Fig. 3: Basic operational amplifier circuit of the controller.

control amplifier. The error signal is negative or positive depending on whether the controlled variable signal is above or below the setpoint signal. When the process variable and setpoint signals are equal, the process pointer and setpoint pointer 'line up' and there is no error signal

The control amplifier amplifies the error signal to the level required for operation of the final control element. The control amplifier is essentially an operational amplifier which is provided with external variable RC network for producing various types of control responses.

The operational amplifier is a chopper stabilised DC amplifier of very high gain. Various control actions are produced by changing feedback of the control amplifier through RC networks of variable time constants. There is a considerable difference between the open loop and closed loop gain of the system. Inclusion of negative feedback considerably reduces the gain of the system and linearises the system. This increases the stability while decreasing the sensitivity of the system.

The operational amplifier circuit shown in Fig. 3 is the basis for controller action. It consists of an input network and a feedback network in which the current is equalised by the amplifier. If the input current is constant, C_{in} charges to that voltage. The feedback current, produced by this input voltage, charges the feedback capacitor C_{fb}. Once the two capacitors are equally charged, no current will flow. The slight excess of input current necessary to sustain amplifier output is insignificant.

An input error signal causes an input current to flow, charging C_{in}. This amplifier input immediately produces an output or feedback current. Feedback current charges C_{fb} to a value that equals the charge on C_{in}.

Since the reaction of the amplifier is practically instantaneous, the feedback current constantly tracks the input error signal. As these two equal currents vary, adding to and subtracting from the charge of the capacitors, these charges always remain the same. As a result of this action, the summing junction of these two capacitors is always essentially at a ground potential.

(To be concluded)

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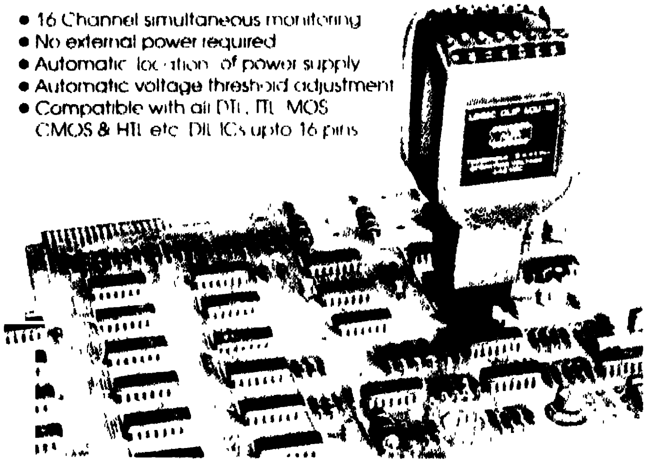

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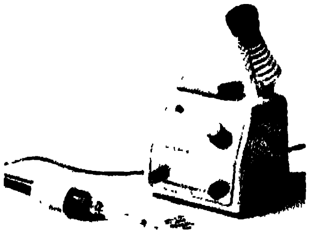

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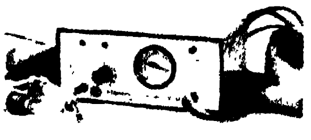

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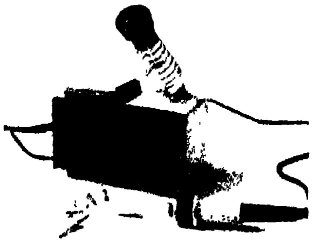

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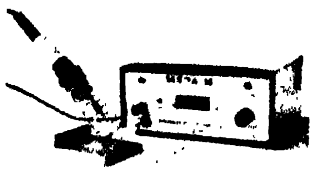

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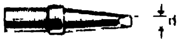
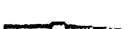
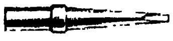
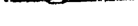
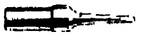
		Screw driver tip	HSD 11 HSD 12 HSD 13 HSD 14	
			HLS 21 HLS 22	
			HCB 31 HCB 32 HCB 33	
		Narrow Screw driver tip		0 6
		Conical Long tip	HCL 51	0 8
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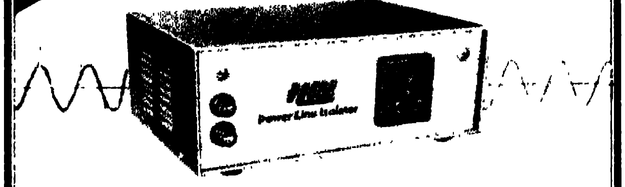

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Electromagnetic Interferences on Power Lines

H.J. Zala

Interferences are the most common cause of malfunction in the electronic system. Interferences can impair correct operation, render operation impossible or even destroy the equipment. Interference can enter into the electronic system through conductive paths like power cables, signal cables, ground etc or through radiative paths like equipment's case, or through both. This situation is shown in Fig. 1.

Power line interferences

Interferences present on power lines are most crucial and are encountered frequently. Noisy equipments like motors, switches, relays etc sharing the same power line add to the interference. Momentary power interruptions also generate interference.

Local power distribution line acts as a huge antenna and picks up all forms of man-made and natural emissions. Lightning during thunderstorm, static electricity generated in the atmosphere and powerful waves generated by broadcasting stations and transreceivers are picked up and distributed to all users in addition to the pollution accepted from other sources.

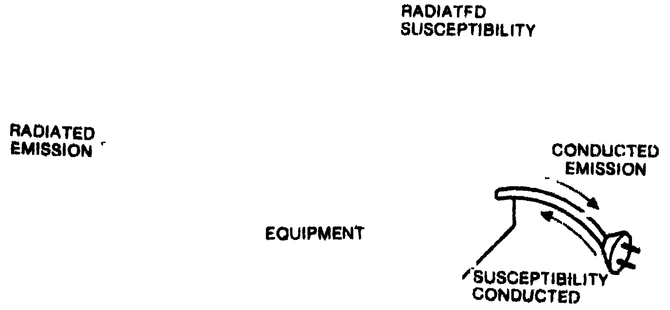


Fig. 1: Various modes of interferences.

Fig. 2 shows a typical plot of conducted emissions present on power lines. The high level of interference present below 1 MHz results from fluorescent lamp and other home appliances within installation. The spectrum beyond 1 MHz is mainly contributed by the broadcast shortwave HF, TV, FM and other electromagnetic emissions intercepted by the power line.

If interferences are to be removed from a power line, it must be established whether the interferences present are in common mode or differential mode. Common mode interference is one in which interference exists between phase-earth and neutral-earth lines. In differential mode, interference exists between phase-neutral lines. Both these states are shown in Fig. 3.

Isolation transformers, chokes and filters are extensively used to reduce interferences present on the power lines. The following paragraphs discuss the characteristics of these devices and the situations in which they can be used.

Isolation transformer

A conventional transformer magnetically couples desired energy from primary to secondary while isolating the windings from one another. However, in such a transformer, isolation between primary and secondary is poor. The noise potential between primary and ground reaches the secondary through resistive and capacitive coupling between the transformer's windings.

Isolation transformer is designed such that the interwinding resistive and capacitive couplings get minimised. In isolation transformer, a grounded conductive foil called

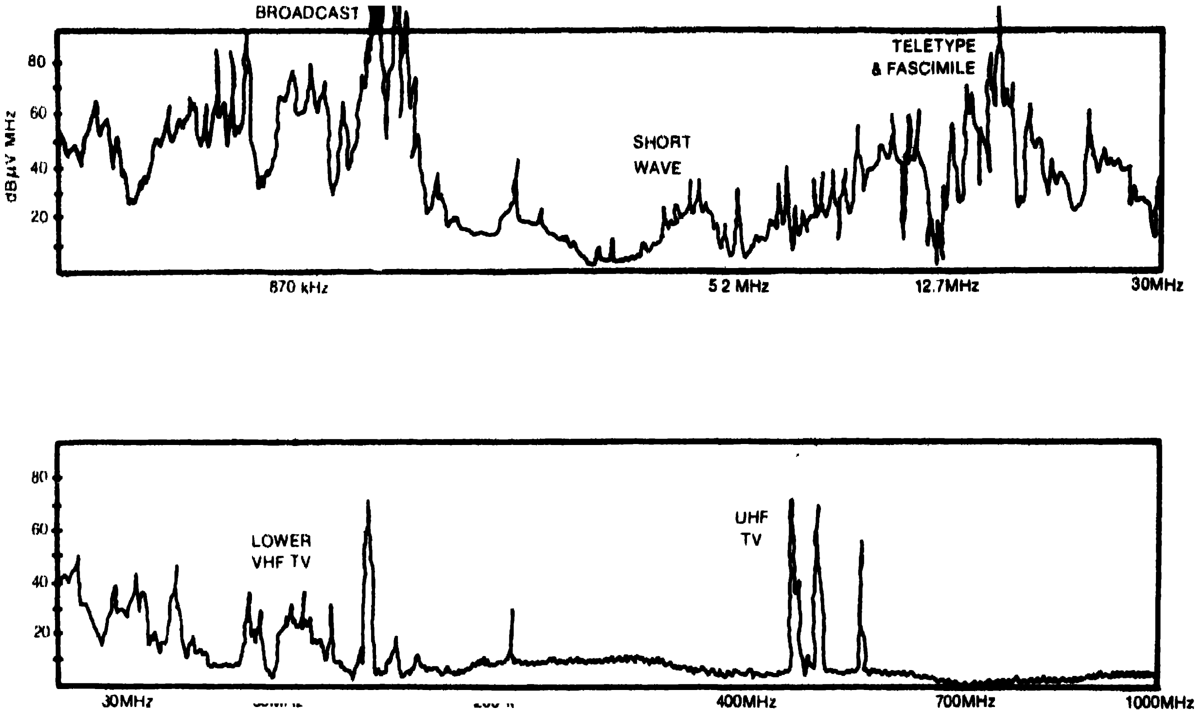


Fig. 2: A typical plot of interferences present on power lines.

faraday shield is placed between the primary and secondary winding to divert most of the primary noise current to ground.

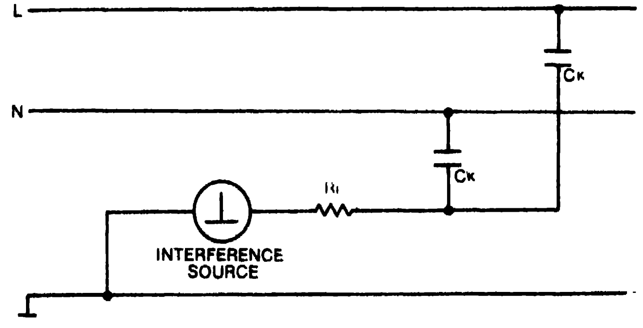
However, electrical noise is still coupled into the secondary because of the electrostatic field around the faraday shield. This problem is overcome by using a unique box shielding technique which provides extremely high impedance of the order of 10,000 megohms and capacitance from 0.005 to 0.0005 pF between the primary and secondary.

An isolation transformer offers common mode rejection from 120 dB to 140 dB. It also reduces differential mode noise to a certain extent. A good isolation transformer effectively eliminates interferences up to 50 kHz. For high frequency interference suppression, filters are used along with the isolation transformer. It is a good practice to use twisted shielded pair and an EMI suppressant tube in the secondary to reduce the differential mode interference.

Chokes

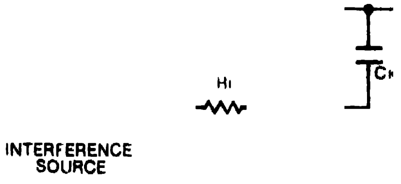
Although it is possible to use large value capacitors between phase-earth and neutral-earth power lines, safety regulations in most of the country limits their value. The capacitor between phase and neutral is limited to keep the switching current to a reasonable value, when load is switched on and off. Hence with capacitors alone, it is not possible to reduce interference to a desired value and normally inductors are used with capacitors. There are three types of chokes used in interference suppression:

1. Saturable choke.
2. Multiple ring-core choke.
3. Rod-core choke.



(b)

Fig. 3(a): Differential mode interference.



(a)

Fig. 3(b): Common mode interference.

Saturable choke. Saturable core offers high inductance at switch-on when current is zero and low inductance when core magnetic material gets saturated, i.e. at nominal current. An attenuation of about 70 dB can be achieved using these chokes.

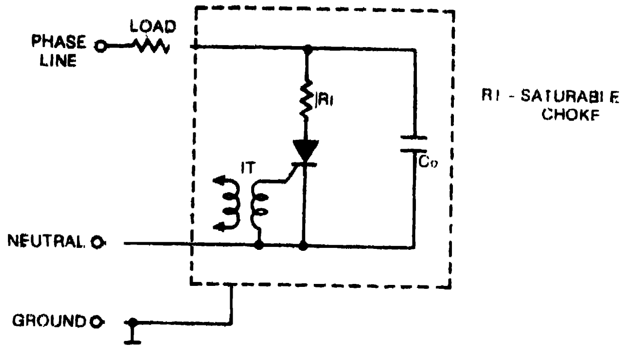


Fig. 4: Typical application circuit for a saturable choke.

A typical application circuit is shown in Fig. 4. A saturable core is connected in series with thyristor which extends the current rise time, thereby reducing the differential mode interference.

Ring-core choke. Common mode interference is attenuated using ring-core choke. Ring-core choke consists of two or more identical windings. One winding is introduced in phase and the other in neutral line. The 50Hz current, which induces magnetic fields in the ring core is self-cancelling and hence no voltage drop at 50 Hz is experienced, whereas common mode interference produces supporting field and hence gets attenuated. A typical application circuit is shown in Fig. 5.

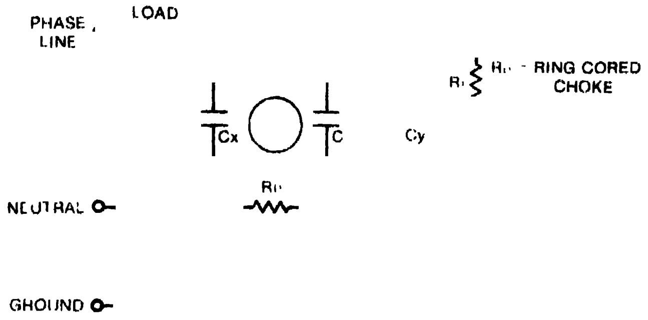


Fig. 5: Typical application circuit for a ring-core choke.

Rod-core choke. When the load current is more than 100 amperes, then instead of saturable choke, rod-cores are used. The inductance of rod-core choke always remains constant.

Power line filters

It is preferable to filter out interference before it gets to user areas. This is accomplished by the use of power line filter. Power line filter passes the 50Hz mains frequency with very little attenuation and provides high attenuation from low frequencies such as 1 kHz to 1 GHz, depending upon the type of filter used.

The objective of the filter is to reduce both common mode and differential mode interference to a harmless level. For removal of common mode interferences, filters must be placed between phase-earth and neutral-earth lines. For the removal of differential mode interference, filter must be placed between phase-neutral lines with or without involving earth line.

Understanding of filter parameters greatly helps in selecting the proper type of filter. A brief description of these parameters is given below.

Rated voltage. This represents the maximum admissible continuous operating voltage. If this voltage exceeds by 20 per cent then the filter might get damaged.

Rated current. This is the maximum operating current that the filter handles at a specified temperature. The rated current reduces with increase in temperature

Leakage current. Common mode interference is reduced by connecting capacitors between phase-earth and neutral-earth power lines. When the AC voltage is applied, a current flows through these capacitors to ground.

For safety reasons, this current must not exceed a certain maximum value. There are certain regulations regarding the interference current which can be pumped to the earth terminal. In fact, these regulations along with operating voltage determine the size of capacitors which can be connected between phase-earth and phase-neutral lines. Table 1 gives the leakage current limits for a typical class of equipments.

TABLE 1

Maximum Admissible Leakage Current as Per IEC Standard

Class of Appliance and Application	**Leakage Current (max.)**
Domestic	
Portable	0.75 mA
Fixed location motor equipments	3.5 mA
Fixed location heating equipments	5.0 mA
Medical appliances	
Analytical	0.5 mA
-Medical	0.1 mA
Computers	0.5 mA
Instruments	3.5 mA

Insertion loss. This is the ratio of output voltage to input voltage at a particular frequency, expressed in dB. This represents how much each frequency component of interfer-

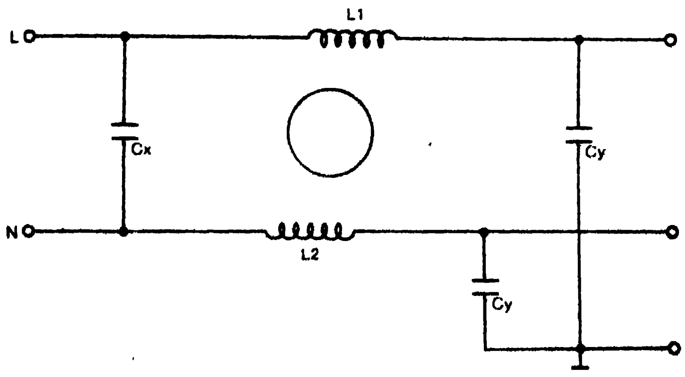


Fig. 6: Typical configuration of a reactive filter.

ence will be attenuated while passing through the filter.

An important point to be noted here is that the figures given in the manufacturer catalogue represent the measurement taken with 50-ohm source and 50-ohm load impedance. This is hardly the case in actual practice. Hence, depending upon the source and load impedance, you may get better or deteriorated performance.

- While studying the manufacturer catalogue, clear distinction should be made between attenuation offered for common mode and differential mode and should be compared with the requirements.

Different filter configurations

Mainly three types of filters are available: (i) reactive filters, (ii) lossy line filters, and (iii) active filters.

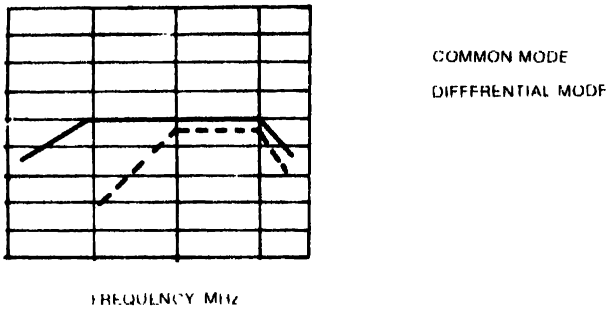


Fig. 7: Attenuation characteristics of typical reactive filters.

Reactive filters are widely used. Lossy line filters are a relatively new concept and offer better performance compared to reactive filters. However they are costly. Active filters are normally not used in power line filtering applications.

Reactive filters

Reactive filters basically consist of a combination of high impedance series circuits (chokes) and low impedance parallel circuits (capacitors) of desired frequency range.

Fig. 6 shows the typical configuration of a filter. Capacitor Cx connected between phase-neutral is responsible for the attenuation of differential mode interference. Inductors L1 and L2 offer high impedance paths to common mode signals and attenuate them, while offering little attenuation to operating frequency. These inductors are constructed on ring cores with two identical windings. These windings are arranged symmetrically so that the operating current (50 Hz) produces opposing fluxes in the two windings of the magnetic materials. This prevents saturation of the core materials at the nominal operating current.

In contrast, for the common mode signal, two fields support each other and hence experience full attenuation. The remaining common mode interference current is returned to the earth via capacitor Cy. Attenuation of interference is directly influenced by the value of Cy. However, as mentioned earlier, their value is limited by regulation of maximum admissible earth leakage current. Fig. 7 shows the typical attenuation obtained by this configuration.

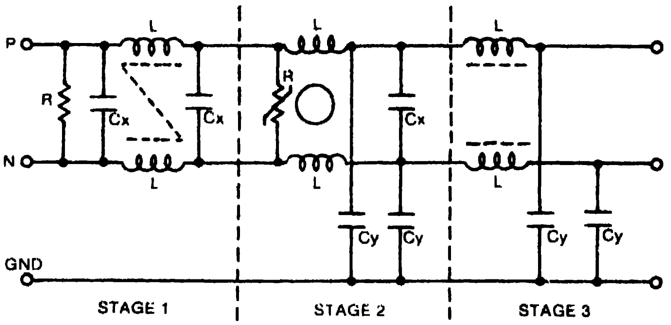


Fig. 8: Wide-band filters for stringent attenuation requirement.

Wide-band filters for stringent requirements are often made up by combining two or three stages (Fig. 8). The frequency range of such filters can easily extend up to 1 GHz. Sometimes, resistors are added to discharge large capacitors connected between phase-neutral. Surge diverters, like varistors, are often used to limit large transients present on the power lines.

When there is a possibility of large common mode interference, filters with earth-line chokes are used (Fig. 9). When external interference occurs simultaneously on all the three lines, then only interference current flowing in the phase and neutral lines are effectively attenuated by the filter. The current flowing in the earth line, however, gets into the equipment without hinderance and flows back via HF-earth as a displacement current to the interference source.

An earth-line choke at the filter input effectively attenu-

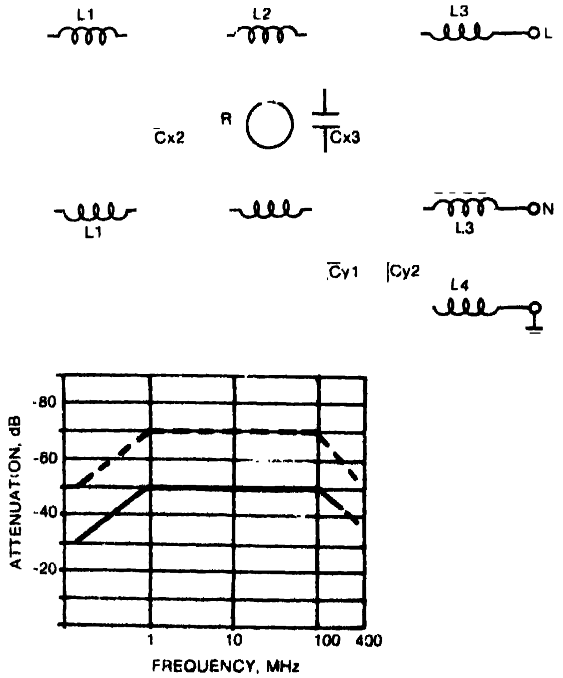


Fig. 9: Filters used with earth-line chokes to overcome large common mode interferences.

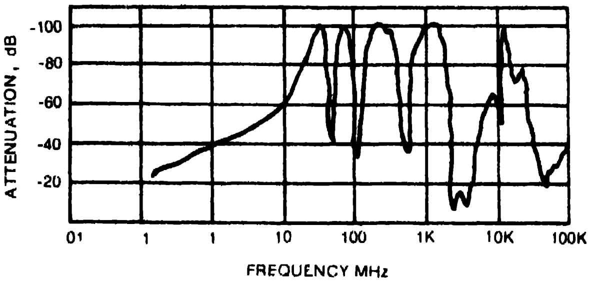
ates this common mode interference current. Filters with earth-line chokes have in general a 10dB higher attenuation compared to reactive filters.

Lossy line filters

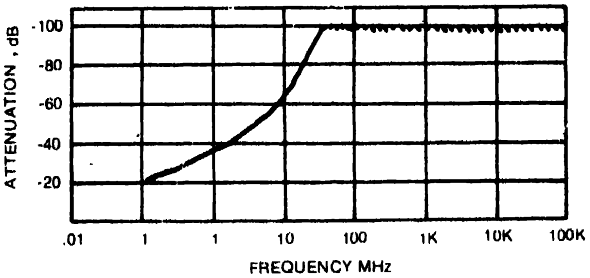
The principle involved in the lossy line filter is different than the conventional one. Here, the unwanted interference energy travels through a 'lossy' medium surrounding the conductor, where it is absorbed and dissipated. The lossy medium offers high interference attenuation and low Q.

The main advantage of lossy line filter over the conventional reactive filter is that here the unwanted energy is absorbed rather than rejected. Hence, the problem associated with reactive type filters like mismatch, reflections, grounding and high VSWR are absent here.

Practically no reactive current is present because there is little shunt capacitance. Since there is no saturation at high currents, this type of filter offers constant attenuation at all types of load conditions. Here, the ringing problem associated with interference spike rejection is not present, as energy is absorbed rather than rejected.



STANDARD LOW PASS REACTIVE FILTER



LOSSYLINE LOW PASS FILTER

Fig. 10: Comparison of attenuation characteristics of reactive filter and lossy line filter.

This type of filter offers attenuation of 50 dB and more in the frequency range of 10 kHz to 100 GHz. Fig. 10 shows the comparison of attenuation characteristics of conventional reactive filters and lossy line filters.

This type of filter is also available in flexible cable form. Construction details for this are given in Fig. 11. This type of filter is very useful in high frequency applications. These are available in various sizes and current capacities.

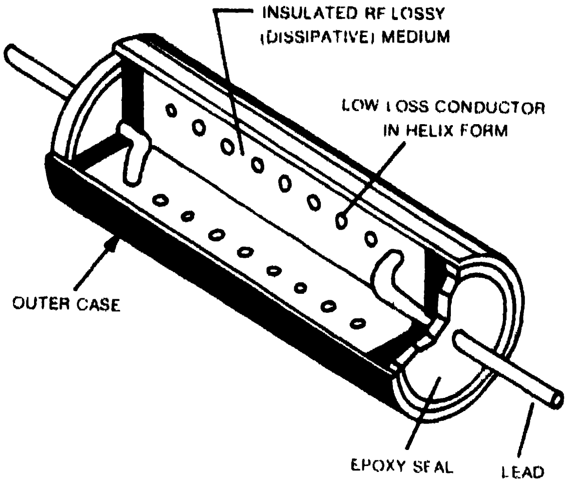

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Fig. 11: Cut-section of a lossy line filters.

Suppressant tubes

Suppressant tubes provide a simple, low cost, efficient means for suppressing unwanted interferences. They are merely slipped over insulated or uninsulated standard wires or cables.

Suppressant tubes are made up of lossy materials, which absorb high frequency energy. Suppressant tubes will not cause DC or low frequency AC losses. They are available in different diameters from 1.25mm to 12.5cm and offer an attenuation of 20 dB at 100 MHz and 100 dB at 1 GHz and above. □

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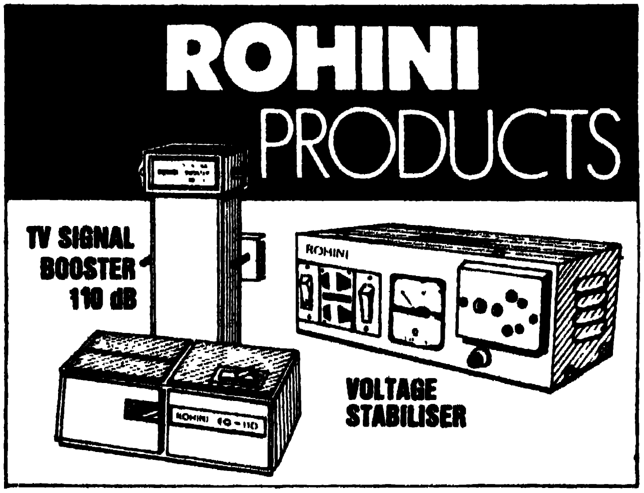

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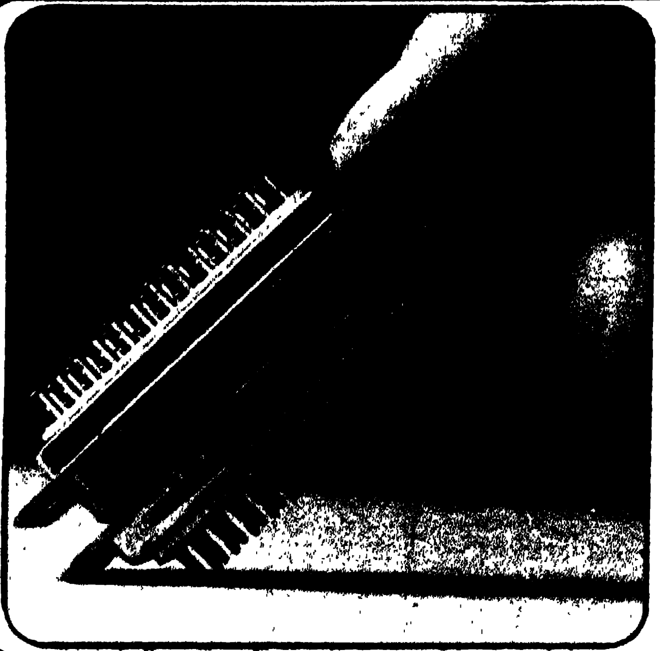

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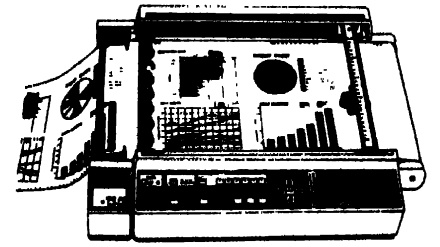

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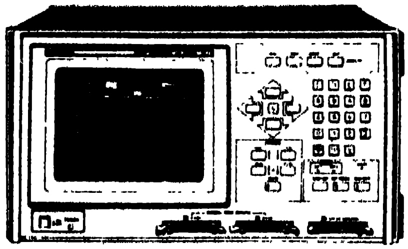

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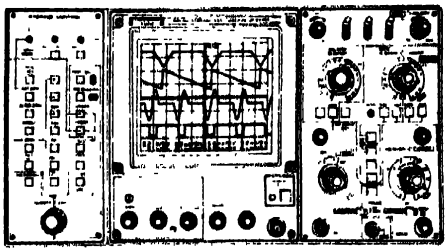

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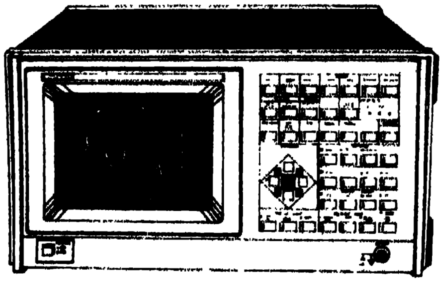

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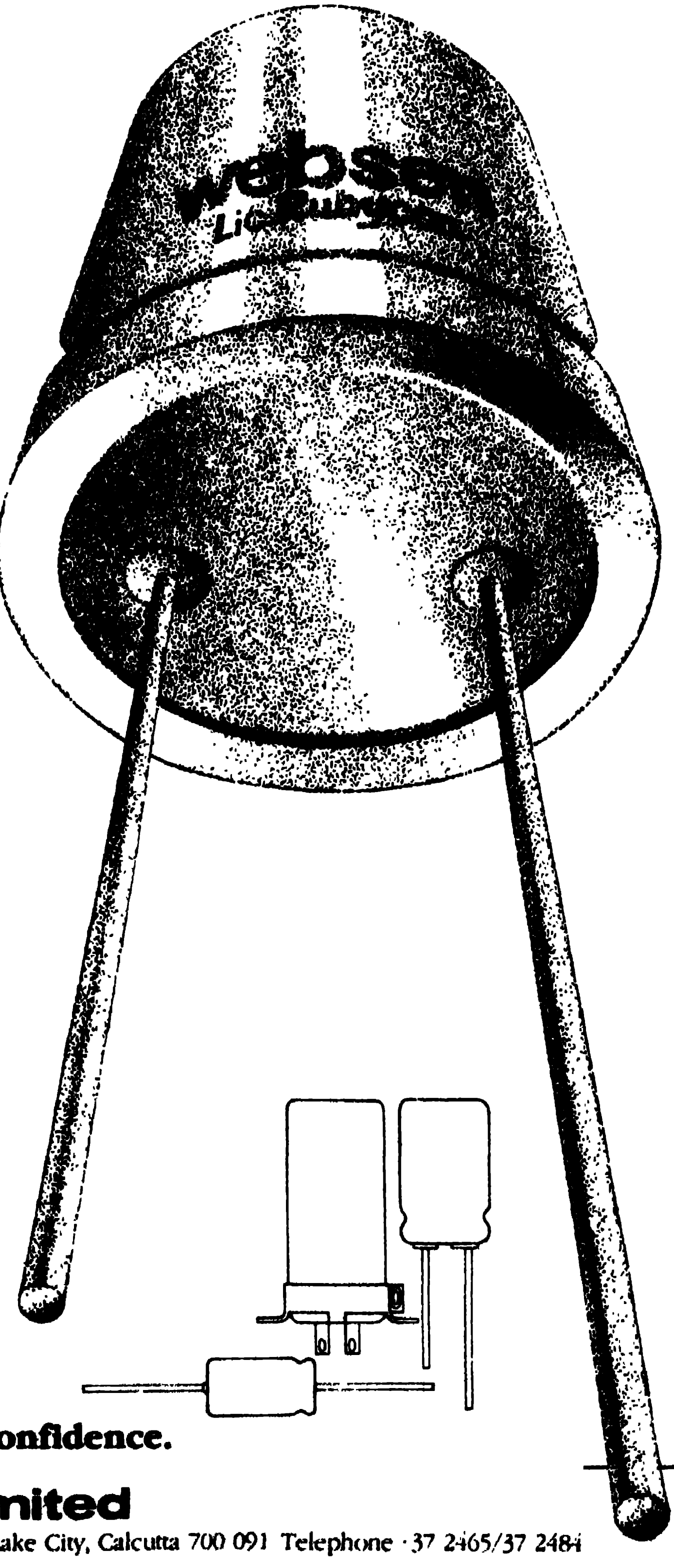

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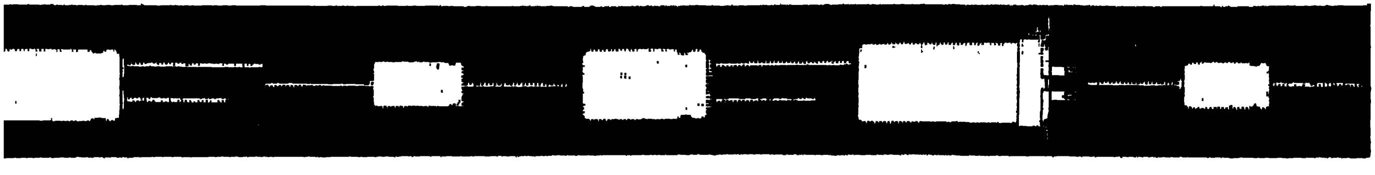


Organising an Electronic Unit for Mass Production

Part I

C. Mohan

The growth of electronic instrument industry has been phenomenal over the last ten years. With the introduction of consumer electronic products like B&W and colour television receivers, it has won its laurels. In India, a lot of industries have sprung up in the organised sector for manufacturing B&W and colour television receivers, tape recorders, radios, two-in-ones, plain paper copiers, electronic typewriters and personal computers.

All these products are mass-produced the world over because of their mass marketability. Also, even professional instruments like electrocardiographs need to be mass-produced in India in order to offer competitive prices for the export market.

The scope of this article includes organisation, production aids, testers, software, production management, inspection and designing for mass production. Sales and financial aspects have been excluded from the discussion.

MPU ORGANISATION

Fig. 1 shows the organisation chart of a mass production unit (MPU). Here, except sales and design departments, all the other departments are under the MPU executive, the manufacturing manager. These two functions must be separated from the manufacturing manager in order to efficiently organise the unit. We assume that there is steady demand for the MPU product and any reasonable increase in production levels will be absorbed by the market. Checking the design aspects and trying to improve them do not concern the manufacturing manager although he may discuss the matters with the persons concerned. Similarly, we assume that the manufacturing manager is not to bother about arranging and controlling finance although he is required to keep the inventory to the minimum possible and ensure good production.

Assembly line is controlled by the assembly manager who is responsible for shop scheduling, assembly and testing. Chief quality control officer takes care of incoming, on-line and finished product inspection. It is essential that both these inspection departments are under one person since there is bound to be difference of opinion regarding some quality aspects, particularly attributes if they are controlled by two persons. Material controller manages stores, planning, Kardex control and purchase.

As soon as sales targets are received, he plans for procurement. Accounts officer is there to make payments and account money received from head office. Maintenance department looks after periodical preventive maintenance and attends to breakdowns. Zero or minimum downtime of any machinery is the aim of this department. An administrative officer is also available for general, personnel and administrative routines.

PRODUCTION AIDS

Production aids are equipments which help manual, automatic or semi-automatic assembly in an MPU. If the operators' attention and intervention required in the assembly are very minimal, it is called automatic assembly; if the assembly requires frequent operators' intervention and still is better than manual assembly, it is termed semi-automatic assembly.

Programmable locators

There are several semi-automatic programmable locators with which either component insertion or wire-wrapping can be carried out in an easy and speedy way suitable for MPU.

A typical unit available from Assembly Automation can be used for component insertion as well as wire-wrapping.

Component insertion. The unit contains cassette memory, plug-in keyboard, universal board edge mounting rails, LED lighted parts, bins and DIP dispensers for the purpose.

Mr C. Mohan is the deputy production manager at BPL India, Bangalore and specialises in mass production methods. He has authored and co-authored several articles on electronics, organisation, management, methods and manufacture, both in Indian and foreign journals.

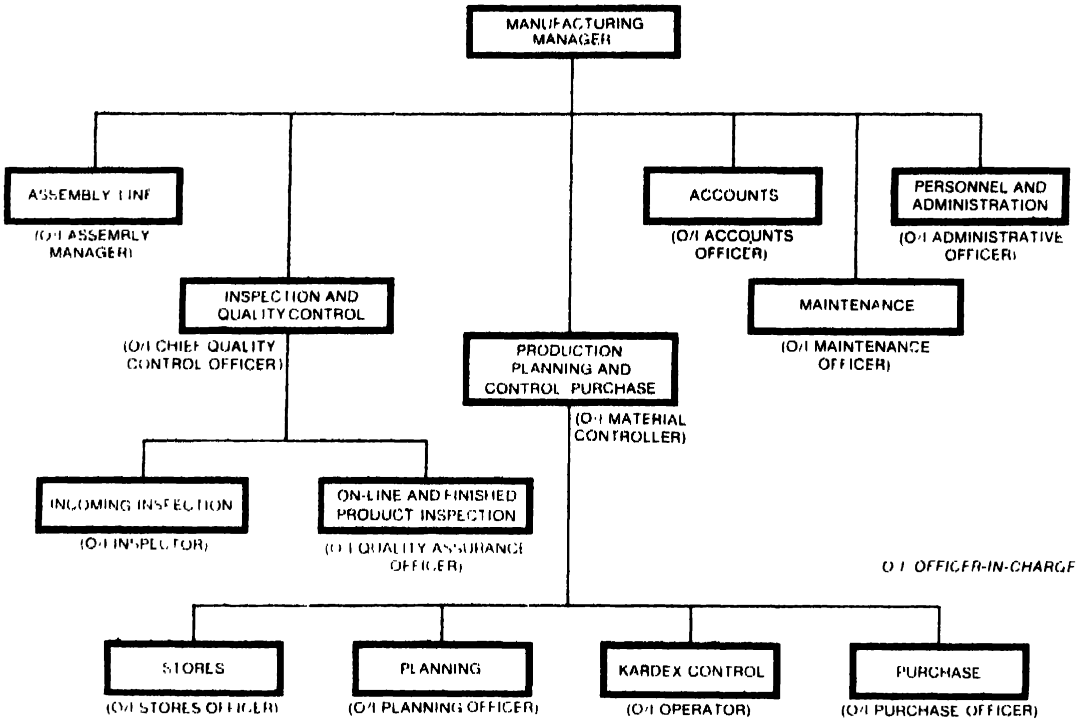

MANUFACTURING MANAGER
ASSEMBLY LINE
(O/I ASSEMBLY MANAGER)
ACCOUNTS
(O/I ACCOUNTS OFFICER)
PERSONNEL AND ADMINISTRATION
(O/I ADMINISTRATIVE OFFICER)
INSPECTION AND QUALITY CONTROL
(O/I CHIEF QUALITY CONTROL OFFICER)
MAINTENANCE
(O/I MAINTENANCE OFFICER)
PRODUCTION PLANNING AND CONTROL PURCHASE
(O/I MATERIAL CONTROLLER)
INCOMING INSPECTION
(O/I INSPECTOR)
ON-LINE AND FINISHED PRODUCT INSPECTION
(O/I QUALITY ASSURANCE OFFICER)
O/I OFFICER-IN-CHARGE
STORES
(O/I STORES OFFICER)
PLANNING
(O/I PLANNING OFFICER)
KARDEX CONTROL
(O/I OPERATOR)
PURCHASE
(O/I PURCHASE OFFICER)

Fig. 1: Organisation schematic of a mass production unit.

The operator merely picks up the part from a bin indicated by its LED lamp and inserts it into the board where a light dot appears. The direction of the part is oriented according to a lighted symbol on the panel above. The only thing the operator has to recognise about the part is the plus end or pin 1 of a multi-pin part. Fig. 2 shows part of the unit. Component location lamp, corresponding orientation lamp and component bin lamp are sequentially switched to remove insertion errors.

Bench or floor model bin sets provide easy access to 50 or 100 different discrete parts. These bins are grouped in sets of five to provide a quick load/unload feature for convenient pre-kitting of jobs. Conductive bins for keeping MOS devices are available. Static protected IC DIP dispensers for up to 40 different devices are provided. Each removable tray fitted conveniently on the unit can hold up to 10 tubes of approx. 7.6mm, 10.1mm and 15.2mm wide ICs.

Programming for component insertion is extremely simple. It is accomplished by mounting a sample board in the machine and 'walking through' the assembly process. Horizontal and vertical keyboard controls are used to drive the light dot source behind the board to a particular component hole. For each part, a two-digit quantity for one board, bin number and orientation in 45° increments (flashing if polarity is required) are keyed in.

After 400 components have been completed, an audible signals that machine memory is full and this block of m has to be permanently stored. This is done by a fresh cassette into the built-in mini-cassette unit and pushing a 'write' button. If more steps are needed, programming may now continue for another 400 steps and so on until the board is complete.

Up to 16 boards can be assembled on the machine at one time with a single-board program automatically repeated at each board whose origin point has been designated. Board positions may be skipped at any time by eliminating the corresponding origins. During assembly, cassettes are read into machine memory in 400 step blocks. The operator uses a foot-switch to move from step to step within the block. An audible tone signals when a bin change occurs and a new part is needed. If a board is completed in 400 steps or less, the operator merely pushes 'reset' to start a new board at step 1. Controls are also provided for fast stepping and backward stepping.

There is no software requirement in the unit. Also, X-Y coordinate information about the parts to be loaded need not be fed to the unit.

A 'stretch-shrink' feature allows deleted steps to be removed or new steps added and the remaining steps renumbered automatically. Changes and additions are quickly made by advancing to the block and step of concern, switching to the program mode to make the new setting, storing this step, and again writing the block.

Wire-wrapping. A moving tool rest serves as a guide for the tip of a hand-held wrapping tool and automatically aligns with each wire wrap pin in a programmed sequence. The operator is thus freed from the tedious and error prone task of taking information from a written list and usually searching for the correct place to put the wire. Instead, the operation may be done with very little concentration and visual effort.

Here also programs stored on magnetic tape cassettes are read into machine memory, 400 steps at a time for execution. The operator uses a foot-switch to advance through the 400-step block. Digital displays and controls are provided to show step number, wire length or bin number, wire routing (if needed) and second end of wire indication. Controls allow back stepping, fast stepping and resetting to step 1. LED-indicated wire bin sets provide easy access to 18 or 36 pre-cut and stripped wires.

Programming consists of mounting a sample board and driving the pointer to each pin in the desired sequence with keyboard controls. The machine will automatically calculate the required wire length. Alternately, a wire length or bin number may be entered manually from the keyboard. LED arrow symbols may be programmed to light or flash to indicate wire routing and second end of wire information. Each step is stored in machine memory by pushing the 'store' button. By a combination of fast slewing and stepping 2.54mm per keystroke, an operator may quickly drive from one pin to any other that is on the same 2.54mm grid pattern without worrying about exact alignment. Off-grid positions can also be handled.

As in the component insertion operation, after 400 steps have been completed an audible tone warns that machine memory is full and this block of program must be permanently stored. This is done by inserting a fresh cassette into the built-in mini-cassette unit and pushing a 'write' button. Programming may now continue until the board is completed. Each cassette holds four 400-step blocks. Average programming time for a given board is less than the time required to manually wrap the same board. Fig. 3 shows the wire-wrapping arrangement.

Wire-wrapping tools

In an MPU product, the need for a faster, more reliable and inexpensive method of making electrical connections has become a necessity. The solderless connection by wire-wrapping technique is now a standard method of making connections to terminals in high density MPU products. The strength of a wire-wrapped connection is considerably in excess of that of a solderless one. It is less easily stripped from the terminal and is less subject to breakage. The contact areas of a wire-wrapped connection remain gas tight when exposed to temperature changes, corrosive atmospheres, humidity, and vibration.

A wire-wrapped connection is made by coiling plated copper wire around the sharp corners of a terminal under mechanical tension. By this, the oxide layer on both wire and terminal is crushed or sheared, and a clear, oxide-free metal-to-metal contact is obtained (Fig. 4). The terminal must have at least two sharp edges.

A distinct advantage of wire-wrapping is the ease with which a wire may be removed from a terminal to correct errors or modify wiring. An unwrap tool is slipped over the terminal, engaging the first turn of the connection. By rotating the tool, the connection is removed within seconds without damage to the terminal.

Generally, bare wire is wrapped around the terminal. Alternatively, in addition to the bare wire, a portion of insulated wire can also be wrapped around the terminal. Fig. 5 shows these two situations.

There are four types of wire-wrapping tools: (i) pneumatic, (ii) electric-powered, (iii) manual, and (iv) battery-powered.

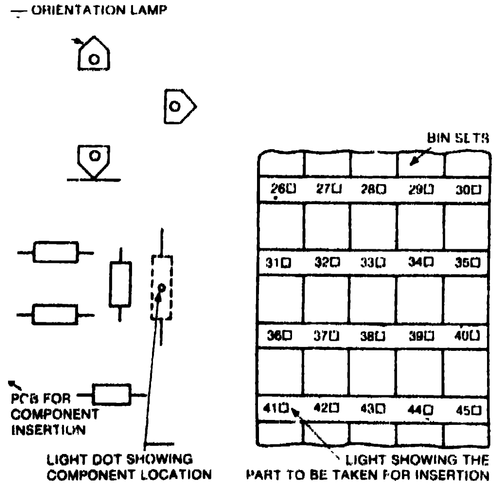
Pneumatic wire-wrapping tool is air-powered The flexible air hose in the tool is connected to a compressor. The tool-head rotates at about 3000 to 4500 RPM. It receives air at about 80-100 psi through a hand-operated switch. Any wire size between 0.2 mm and 1 mm can be used.

The electric-powered wire-wrapping tool is available for 110, 48, 220 and 240 volts AC/DC operation. A motor rotates the tool-head at about 4000 RPM at the flick of a switch. Some manufacturers incorporate a back force device to prevent over-wrapping which might otherwise occur with small wire diameters. Optionally, it is provided with a reversing switch for power unwrapping. Also, wire cut-and-strip attachment is available for PVC insulated wires.

Manual wire-wrapping tools are designed to produce wire-wrapped connections by merely squeezing the trigger. Each squeeze of the trigger provides ten revolutions of the bit on the tool-head. Fewer wraps can be achieved by adjusting the strip length of the wire.

Battery-powered wire-wrapping tool uses two C-size rechargeable nickel cadmium batteries. This light weight tool can unwrap if the batteries are put in reverse. Anti over-wrapping device is optionally available.

All types of wire-wrapping tools find use in an MPU in different stages of production. One has to take the following


ORIENTATION LAMP
BIN SLTS
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PCB FOR COMPONENT INSERTION
LIGHT DOT SHOWING COMPONENT LOCATION
LIGHT SHOWING THE PART TO BE TAKEN FOR INSERTION

Fig. 2: Programmable locator—component insertion arrangement.

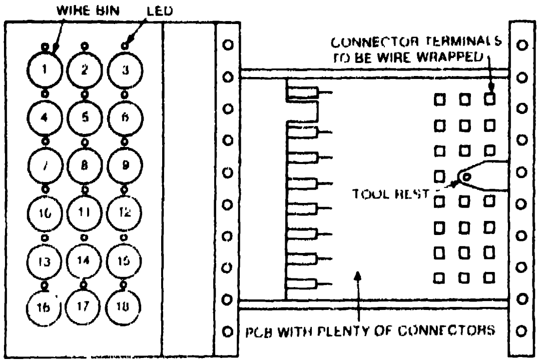
WIRE BIN
LED
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
CONNECTOR TERMINALS TO BE WIRE WRAPPED
TOOL REST
PCB WITH PLENTY OF CONNECTORS

Fig. 3: Programmable locator—wire-wrapping arrangement.

precautions while using these tools:

1. The tool should be kept on the terminal until the wrap is complete. Early removal can result in spiral and open wraps.
2. Tool should not be pressed hard. Excessive pressure can lead to over-wrapping.
3. Each wire size has a tool bit and corresponding sleeve. Wrong bit and sleeve can cause loose wraps.
4. The stripped end of the wire should be pushed in all the way.

If too many interconnections through wires and flat cables are present in an MPU product, then probably aids such as automatic wire-strippers and flat cable and tubing cutters are required.

Automatic wire-stripper. In such a unit made by Eubanks, a keyboard is used to select wire length, number of pieces produced and delay between cut and strip actions. Cut and strip assemblies are powered by compressed air. The microprocessor in the instrument can be programmed from the keyboard to store as many as ten separate combinations of lengths and batches, any of which can be called up at will. Three types of stripping blades are used: V-type, radiused V-type and die-type.

V-type blades are adjustable to accommodate a range of wire sizes. They are used for soft insulations such as PVC.

Die-type blades are made to fit both the conductor and the insulated diameter of the wire. They cut through most—but not quite all of the insulation. The thin remaining section of insulation is broken by being pulled against the blades by the strip assembly clamps, thus minimising the possibility of nicked or scraped wires.

Radiused V-type blades have a radiused cutting edge in the throat of the vee that fits the conductor. Unlike die-type blades, they can be used to strip wires with different insulation diameters.

Blades are available for stripping teflon, kynar, vukene, tefzel, mil-ene, kapton, rubber, glass, PVC and other wrapped or extruded insulations. Wires need not be of single conductor only. They can be coaxial, cable, power cable, telephone cable etc.

Flat cable and tubing cutters cut plastic tubing, wire, ribbon cable, tape and other linear material to preset lengths accurately and at high speed. It uses a stepping motor to drive the feed rolls. Cutting lengths are variable from 0.5mm to 2539.9cm in increments of 0.5mm. Both wire lengths and batch count are entered through the keyboard.

Soldering station. For repair work in an MPU, small soldering stations should be installed in various stages. Almost all latest products carry MOS and CMOS devices. These devices warrant use of 24-volt low leakage, grounded iron in the soldering station although it may receive 230 volts AC. It is better if temperature control (100°C to 500°C) is also provided.

Desoldering aids. Nowadays most equipments carry plated-through hole (PTH) PCBs and multilayer PCBs from which components cannot be removed easily for repairs. Heating the solder which holds the component and vaccum-sucking it is the method to be adopted. Desoldering stations do this job nicely. Installing these at all essential points in an MPU is a necessity.

The desoldering station is fitted with a vacuum pump which does not require external supply of air. The vacuum pump is activated by a foot-switch. A pistol grip iron which carries a see-through solder collector and a hollow desolder-bit heats and sucks the solder from the PCB. Temperature to the soldering iron is controlled through a switch. This facilitates widest variety of desoldering applications. In general, a 30-watt soldering iron is provided. The suction hose is made out of heat-resistant material which eliminates the possibility of accidentally piercing the hose with the heated tip.

Manual desoldering pumps are also available in plastic construction as well as metal construction. In the metal construction type it will be conductive through the full length of the tool. The tip is a special bronze alloy composition designed for long life and static electricity discharges automatically through the hand of a grounded operator. In this manner it becomes suitable for removing sensitive CMOS components. Suction is by a spring loaded piece of plastic or metal which gets released by hand trigger. It is obvious that a soldering iron has to be used in conjunction with this manual desolder pump to melt the solder for sucking it. Teflon tip is also used in the manual desolder pumps.

Device handler. Some devices have to be handled very carefully to avoid electrical and mechanical damages. For example, MOS devices will fail if exposed to static discharges. To avoid this, an automatic device handler has been

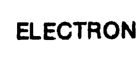

Fig. 4: Wire-wrapping mechanism.

designed. The speed achieveable is a desirable quality in an MPU.

A typical handler fits dual-in-line ICs into sockets of testers, removes them after the tests are over and then discharges them into one of the predesignated output reservoirs. Speeds as high as 3600 devices per hour can be achieved. Handler and test system should be properly grounded. Errors possible in manual handling of devices are totally eliminated here. In fact, this automatic handler can be a part of the test system.

Lead bender. There are hand tools for rapidly bending component leads to preset dimensions. Pointers on the tool accurately set the lead distance to match hole to hole locations on the PCB. Setting and bending adjustments are made by simply turning a thumbwheel to the desired spacing.

Lead wires are securely held during forming to prevent lateral stress on component body. Components are always positioned centrally, for equal leg length. A commonly available model will bend 0.4mm to 1.4mm diameter leads with an easy squeeze of the handles (Fig. 6).

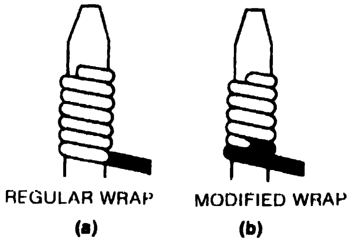

Fig. 5(a): Bare wire wire-wrapping.
Fig. 5(b): Part of insulated wire wrapped.

Cut-and-clinch tool. After inserting the component into the PCB, the extra lead lengths are cut. The components should be held to their respective locations before soldering. Hence while cutting the leads, they should be clinched flush to the PCB as shown in Fig. 7. Cutting and clinching in one stroke burnishes the lead which will improve subsequent solder wetting.

Manual cut-and-clinch tools are available for the purpose. In order to reduce operator fatigue and speed up board processing, air-powered pneumatic lead cut-and-clinch tools can be used. This also provides single motion cut-and-clinch action and improves solderability by swaging the metal. This requires an opening air pressure of only 50 psi.

Manual IC insertion tool. Most of the present day ICs come in DIPs with either 7.62mm (0.3 inches) or 15.24mm (0.6 inches) width spacing.

Manual IC insertion tools in which a twist of the handle compresses the pins to proper spacing thereby aligning bent-out pins are available. Then one has to simply place the tool on the IC socket on the PCB and depress the plunger for instant and accurate insertion. Most of the tools feature chrome plating throughout. This plating and terminal lug for attachment of ground strap provide reliable static dissipation.

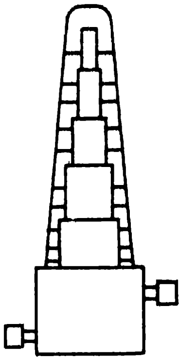

Fig. 6: Simple lead bender.

DIP IC lead straightener. Sometimes, leads of the ICs are found bent even when received from the supplier or while handling. It is essential that we have ICs with straight leads to facilitate automatic insertion, testing etc. Simple, manual DIP IC lead straighteners accepting all standard 8-40 pin ICs on 7.62mm and 15.24mm centers are available.

Fig. 8 shows the construction of the aid. One has to simply attach IC carrying tube and slide ICs through forming rollers.

PCB holders. PCB holders ideal for assembly, testing and repair on a conveyor belt in an MPU are essential. Holder frame rotates full 360° and the steel backed foam cover opens from either end to expose component side of the PCB. Close and lock cover is provided to hold components in place. The cover can flip over frame on pivot to allow for work on the PCB like soldering, cutting, crimping, repair etc.

Generally, the following features are provided:

1. Spring-loaded guides to accommodate various board sizes.
2. Angled board position for ease of use plus minimum fatigue.
3. Adjustable foam-lined retaining cover that adapts automatically to various sized components.
4. Removable center bar to facilitate mounting of several small boards or one larger board.
5. Detachable frame which can be used as a carrier to transport the stuffed board to the next work station or process.

Simple vice-PCB holders are also available. The vice carries nylon jaws which makes delicate yet sure grip action possible. A swivel base with a pivotal holding system is provided. The PCB can be positioned and fixed with locking lever in any random position up to 90° pivotal and 360°

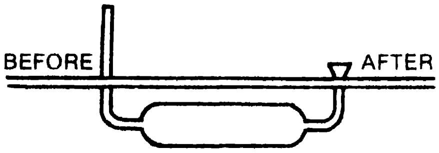

Fig. 7: Clinching before and after.

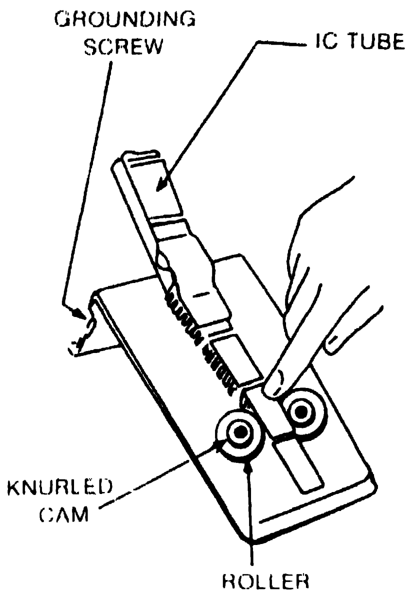

Fig. 8: DIP IC lead straightener.

rotational. Rubber bellows keep tilt mechanism free from dust and contamination. A self-locking hinged foam cover is available for holding components when the PCB is flipped over for soldering.

Air screwdrivers. In order to reduce operator fatigue and improve speed of work in an MPU, air screwdrivers are employed. These are engineered to handle a broad range of fastening and unfastening applications and are powered by air.

Generally, they are built with gear type driving mechanism that generates exceptional power with air. Common features are automatic start with a forward push of the bit upon contact with the screw, instant reverse and torque adjustment for close tolerance, and repeatable torque control. One should choose air screwdrivers as they create less noise.

Automatic component insertion machine

Apart from saving labour, uniform performance resulting in increased reliability can be achieved by using automatic component insertion machine.

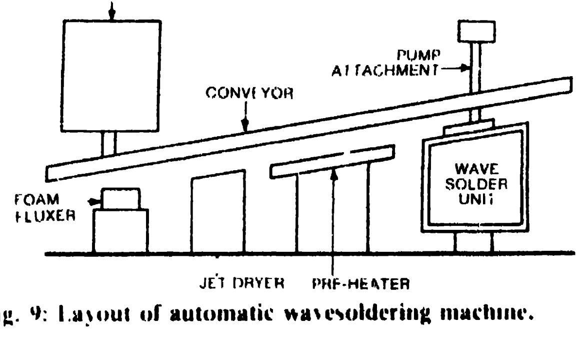

Fig. 9: Layout of automatic wavesoldering machine.

For automatic insertion, the components should be uniformly packaged for presentation to an assembly head. Since not all the components lend themselves to this method, one has to study and decide about the components insertable by the machine.

Most of the axial components are lead-taped by component manufacturers to facilitate automatic insertion. Some special components, or very small components which cannot be lead-taped are packaged in continuous plastic strip. Body taping is generally used for large, heavy axial components. These are placed on reels with interliner ready to be fed into an insertion mechanism.

Methods based on bowl feeding or magazines are adopted for radial lead components. Dual-in-line components like ICs and connectors can be very easily inserted automatically. Numerically controlled insertion machines are available which give insertion rates up to 5000 per hour.

When high volume of only one PCB is involved, as in the case with TVs one can afford to employ what is called 'multiple-station in-line insertion machine.' Here, a series of assembly stations are installed. Each station is fitted with an automatic insertion mechanism which takes care of one type of item. PCBs are conveyorised and time-paced. As the PCBs move on the conveyor, they get loaded with components step by step.

Automatic wavesoldering machine and cutter

This is the most important production aid in an MPU. This receives the PCBs after component insertion into a conveyor. PCB leaves the conveyor after soldering. Fig. 9 shows the inside layout of a typical automatic wavesoldering machine.

The conveyor is either a fixed width type that engages the pins of a PCB carrier or an adjustable width type that engages the PCB directly in titanium fingers. Both types are set at a fixed incline of 6^0. The conveyor has a drive mechanism with variable speed control from 0 to 3m/min. A tachometer on the control console gives readout of conveyor speed. Maximum PCB width that can be processed is limited to 25.4cm or 38.1cm. The PCB carrier supplied has adjustable holding bars which can be set to accommodate any size PCB up to the maximum. The finger type has an adjustable rear rail which can be set to handle PCBs from 2.54cm to maximum width.

The foam fluxer deposits a thin layer of flux on the underside of the PCB, resulting in minimum residue after the soldering operation. The heat of the solder removes most of the flux and the remaining contamination can be removed by a cleaning operation. Low pressure compressed air is diffused through the aerator tube to form a quick wetting flux layer of uniform bubble size. An adjustable air knife removes excess flux to minimise dripping and wastage.

The jet dryer blows hot air on to the PCB to accelerate evaporation of the flux solvent. In addition, the hot air provides a mild initial thermal conditioning of the PCB.

The preheater is a radiating platen which provides an intense heat source to overcome the heatsink of the PCB and raise the flux to its activation point prior to the soldering operation.

The wavesolder unit generates a solder wave which ensures good soldering when the PCBs travel along the conveyor through it. The unit is constructed of stainless steel. There is a pump attached.

In some automatic wavesoldering machines, the PCBs pass over a heated air knife after soldering, displacing bridges, icicles and unwetted solder joints, leaving wetted joints undisturbed.

In-line lead cutters are available which take PCBs after wavesoldering and trim in a single pass of all lead wires. The cutters have two or three high speed blades. PCBs are fed individually into a roller-type automatic palletless conveyor. Adjustment for desired lead length is provided.

Automatic PCB cleaners

There is an aqueous cleaner/dryer which has a conveyorised system of six cleaning and drying stages: (i) prewash to remove gross contaminants, (ii) heated recirculating wash, (iii) heated recirculating rinse, (iv) final rinse of tap, conditioned, or deionised water, (v) and (vi) flash drying sections of tri-vent blower, air knife, and upper and lower radiant panels. This cleaner/dryer when used soon after wavesoldering operation with water-soluble flux helps improve MPU output.

There is a vapour degreaser which is designed for chlorinated, fluorinated and azeotropically blended degreasing solvents. It can be used soon after wavesoldering with rosin fluxes. Cleaning is accomplished by lowering the stainless basket containing the PCBs to be defluxed into the vapour zone. On contact with the parts, solvent vapours condense and cleaning begins. Contaminants are removed by the solvent and drain away with it. Then, still within the vapour blanket, the PCB basket is moved to the cold tank for rinsing. Fresh-solvent flushing by the spray wand completes the process. Solvent is recovered and recycled.

Conveyorised assembly/testing

Various assembly and testing stations of MPU must be conveyorised. Conveyors can be manual, automatic or a judicious mixture of both.

Robots. One can describe a robot as a reprogrammable multifunctional manipulator designed to move material, parts, tools or specified devices through variable programmed motions for the performance of a variety of tasks:

1. They can replace unskilled labour for transferring materials.

2. They can be used on conveyors and rotating tables.

The base of the robot can rotate 330°, the shoulder and elbow 140° and the wrist a full 360° with wrist pitch of 180°. Robots are fast replacing human labour in countries like Japan and USA. Slowly we will also find them to be useful in Indian MPUs also.

(To be continued)

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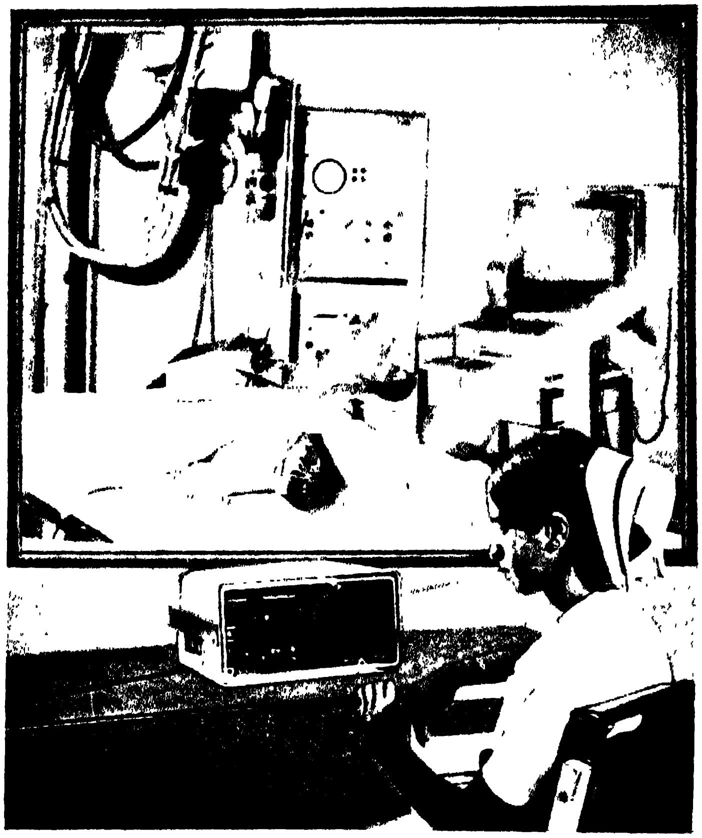

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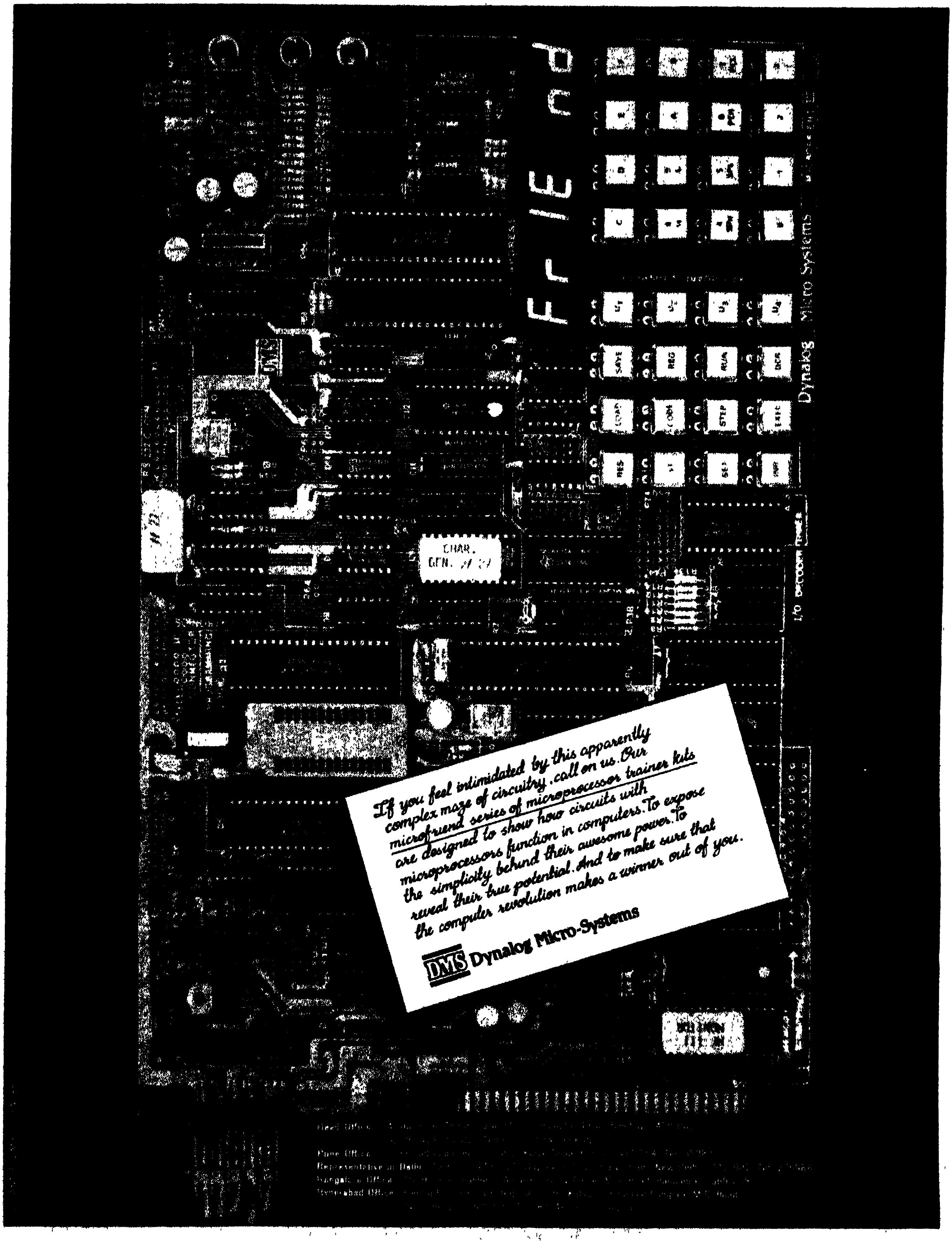

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Comparative Study of Computer Languages

PROBLEM ORGANISATION

Part II

R. Ramaswamy

Any problem which is to be computerised must be properly analysed and organised. Computer time is very precious. One cannot afford to waste the computer time by experimenting on the methods of solving the problem. In fact, the computer user has to spend more time in his study room in preparing the final problem, than he actually spends with the computer to get the calculations done.

Any computer problem must be carefully analysed in advance. All the steps that have to be followed must be carefully set forth in the correct sequence before preparing the instructions for the computer. The computer user must have a thorough grasp of the problem, a clear idea of the available input data and the expected output, as well as the possible alternative processes to be followed under different conditions. Aimless wandering will be ruinous to both the user and the computer. In this article we will study how a problem can be analysed and organised with the help of algorithms and flowcharts.

Problem analysis

Problem analysis consists in finding or deriving the procedural steps involved in getting the solution to a problem. The procedural steps must come within the realm of computer capabilities. It has already been pointed out that the computer can follow only elementary arithmetic logic instructions and so it is the user's job to convert every complex problem into procedural steps containing only elementary arithmetic logic operations.

The famous systems philosophy says that any complex situation is capable of being resolved into a large number of simpler ones and by solving all the simpler ones and integrating their solutions, the complex ones get solved. This philosophy is based on the simple truth that no problem is born big in this world but only grows just like a baby grows into a man or a woman.

How can one go about discovering the elementary steps involved in getting the solution to a complex problem? Unfortunately there is no set method for doing this, but one has to use one's robust common sense and ingenuity to arrive at the procedure. Let us consider a small example to see how to dissect the problem of finding the square root of a number.

Analysing square root problem

Suppose we are asked to find the procedure for finding the square root of a number. To the best of our knowledge, there is no single formula which gives the square root of a number. Obviously, the method involves the use of more than one formula. Let us now ask, what do we look for when we try to get the square root of a number.

In this problem of finding the square root of a number, say A, we look for some number S (called the divisor), which when divided into the given number A (called the dividend), gives a quotient Q equal to the divisor. This wordy description can be written in the mathematical form as

$$Q = A/S$$

If S is equal to Q, then S is the square root of A.

Let us now start the game by making a guess for the square root, say S1. To check whether S1 is the square root, divide A by S1 to get the quotient Q1. Then

$$Q1 = A/S1$$

Now check whether Q1 is equal to S1. If so, it was lucky, since the first guess was the correct square root. If not, we have to make a second guess. This time, the guess should be based on some logic.

Common sense tells us that the next best guess will be the average of S1 and Q1. So the second guess S2 will be written as

$$S2 = (S1 + Q1)/2$$

$$\text{or } S2 = (S1 + A/S1)/2$$

Now check whether S2 is the correct square root by comparing S2 with the quotient Q2 obtained by dividing A by S2. Q2 can be calculated using the formula

$$Q2 = A/S2$$

If Q2 is equal to S2 we have got the answer, otherwise we continue the same process by making the third guess as the average of S2 and Q2. In following this process it will be found that the values of S2 and Q2 approach towards each other and will have to merge sooner or later giving the much needed solution to the problem.

Now, the generalised relation between the ith guess and the (i+1)th guess can be written as follows

$$S_{i+1} = (S_i + A/S_i)/2$$

By a successive application of the above formula, the generated sequence of numbers will come closer and closer to the correct value, finally arriving at the correct value. While man may show signs of tiredness in this method, computers do not show any exhaustion in tackling the problem in this way. Thus, this method is prescribed for the machine, since it is in formula form.

The generalised formula given above is called the algorithm for the square root problem. When this formula is repeatedly applied, until the values of two successive guesses become equal, we get the solution. Readers can test this algorithm by taking the first guess for the square root of 4 as 1. The successive guesses come out as 1, 2.5, 2.05, 2.001 and so on.

Where do we actually stop this process of successive approximation or iteration as it is called? Theoretically, we can stop when the values of two successive guesses become equal. Very often it may not come about because of the limited accuracy of the machine. So it can be decided to stop when the absolute difference between two successive guesses becomes less than or equal to a pre-assigned small value, say .00001 or any other small value depending on the accuracy required. The main point is that we have dissected the problem of finding the square root of a number into a series of elementary steps which can be executed by the computer. That is, we have found the algorithm for the square root problem.

For the square root problem, the algorithm was found fairly comfortably by the so-called intution method. In fact, the above algorithm can be mathematically derived by using the Newton-Raphson method of successive approximation. Mathematical logic is thus nothing but a common sense approach to problems.

One can use specific mathematical techniques available for finding algorithms for various types of problems and one need not always depend on intuition as in the above example. Except in the case of intricate scientific problems, finding the algorithm will prove to be fairly simple.

Flowcharting

Computer users would like to represent the algorithmic steps in a more appealing way, called the pictorial way. The pictorial representation of an algorithm is called the flowchart. Flowcharts are very useful for coding the algorithmic steps into a computer program. Flowcharting is another way of organising a problem for computer implementation. This approach is consistent with the notion that a picture is worth more than thousand words. A flowchart represents the sequence of the different operations to be followed for solving a problem.

A flowchart consists of a number of boxes with certain geometrical shapes joined together by means of flowlines marked with arrows, The direction of the flowlines marked by arrows indicates the flow of logic. Each box represents a specific function and the instructions to perform the program function will be written inside the box in ordinary English language for easy understanding.

A flowchart helps the systematic analysis and organisation of a problem. It also provides a means of experimenting with the various approaches to the problem by a simple re-arrangement of boxes and arrives at the best choice suited to the situation.

A flowchart is a tool to assist the programmer in preparing the program. Its use by the programmer is analogous to the use of a blueprint by an architect. Just as an architect draws a blueprint before a building is constructed, similarly a programmer draws a flowchart before a program is written. A blueprint illustrates the arrangement of the different units to be constructed in a building and their relationship to one another. So also a program flowchart is a drawing which shows the arrangement of the different functions to be performed and their logical interrelationship.

A program flowchart is an essential and integral part of the documentation of the program. By documentation it is meant those explanations or descriptions (pictorial or wordy) which are needed for a complete understanding of a problem by a programmer as well as the user.

It has been pointed out that a flowchart consists of different boxes which represent different program functions connected by flowlines depicting the sequence in which these functions are to be performed. The common boxes used for the different program functions are shown in Fig. 1. Let us now consider four examples for flowcharting and the solutions to these problems.

Flowchart illustration 1

It is better to organise one's thoughts and actions whether one is a computer user or not. In this connection, flowcharting is a good exercise for sharpening one's thinking faculties For example, let us consider the problem of a person, who wants to get a meal he likes at a price he can afford. The orderly steps he has to adopt in achieving his objective is shown as a flowchart in Fig. 2.

The flowchart gives the different steps he has to follow and also the sequence in which these steps have to be followed. Obviously he cannot order for the dish and eat before he enters the hotel and sits comfortably. From the flowchart we find that there are three decision making situations represented by the diamond boxes, when he has to think for

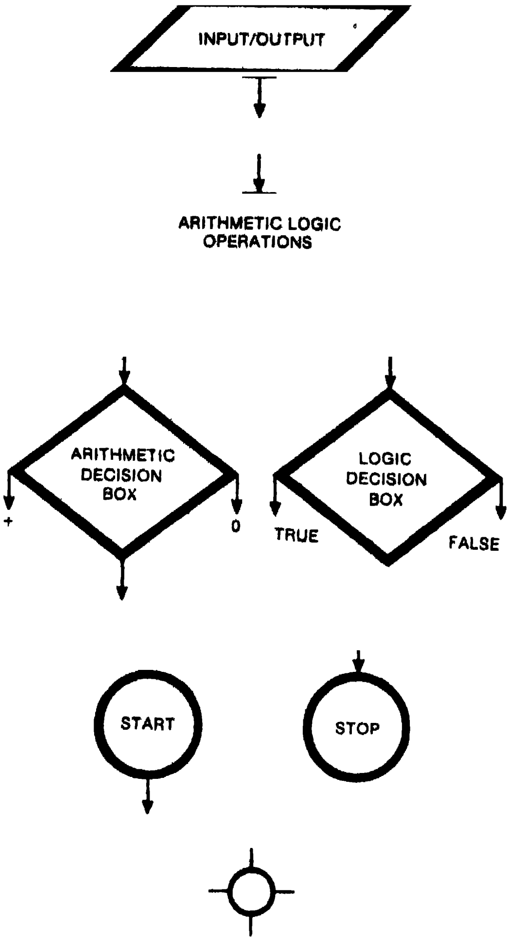


Fig. 1: Common boxes used for different program functions.

a moment and branch off along any one of the alternate paths.

Another important point we have to note is, that one end of the decision box gives instructions to go to another point and repeat the operations over again. This is called looping. Looping is an important technique used in computer programs to perform repetitive type of operations.

Flowchart illustration 2

Three positive numbers A, B and C are given. It is required to flowchart the procedure for locating and printing the smallest of the three numbers.

The normal procedure is to first compare A and B. If A is less than B, then A and C are compared and the smaller of the two is declared as the smallest of the three numbers. If A is greater than B, then B and C are compared and the smaller of the two is declared as the smallest of the three numbers.

The above wordy description of the procedure is very cumbersome and it will be more so, if there is a large number of data to be compared and processed. The procedure for finding the smallest of three numbers is illustrated in the flowchart shown in Fig. 3.

The flowchart tells the procedure to be adopted to achieve this task. First, we read the three numbers. This is called as reading the input data. Then to compare A and B for finding the smaller number, we put the comparison operation in the decision box. If the answer is yes, we go out via the left exit, otherwise we go out via the right exit. There are two more decision boxes, one at the right and another at the left, where the comparisons of B with C and A with C respectively are made. The result is any one of the possible four alternatives, which may be outputted. Fig. 3 is self-explanatory.

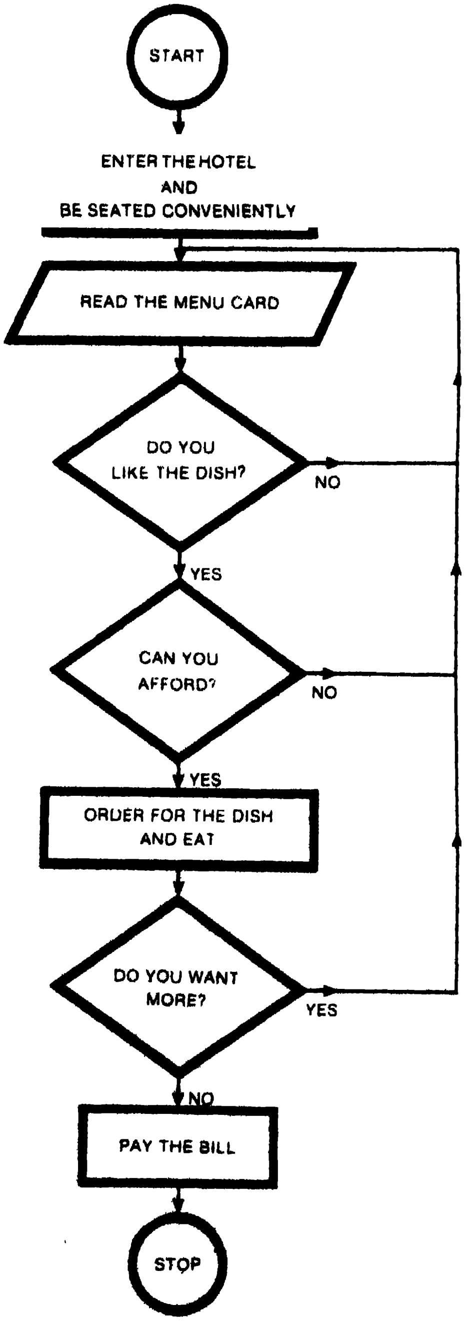


Fig. 2: Schematic diagram for flowchart illustration 1.

Flowchart illustration 3

There are 500 employees in a firm. Draw a flowchart to output the net wage payable to each employee, given the following particulars:

1. The basic pay and the deductions for each employee.
2. The allowances are calculated as follows: (i) HRA is calculated at 23% of the basic, (ii) DA is calculated as follows: DA is Rs 40 for pay up to 299, Rs 50 for pay between Rs 300 and Rs 999 and Rs 60 for pay above Rs 999.

In this problem we have to output the results for exactly 500 employees. So we have to make some provision for counting. This is done by setting up a counter which is automatically incremented by 1 as soon as it processes and prints the result for one employee. We initialise a counter COUNT equal to 0 in the beginning. After printing the result for one employee, we write COUNT = COUNT + 1. This means that the old value of COUNT is incremented by 1 and stored in the same location COUNT.

Then, every time an employee data is processed, we check whether COUNT is still less than 500. If it is so, we go on to read the data of the next employee, otherwise we come out of the loop and stop the operations. The above steps are illustrated in Fig. 4.

Flowchart illustration 4

500 students take a degree examination consisting of six papers. Draw a flowchart to find the average mark obtained by each candidate and declare the result on the basis of the average mark as follows:

1. Declare pass with honours if the average is 75% and above.
2. Declare pass in I class if the average is below 75% but 65% and above.
3. Declare II class if the average is below 65% but 50% and above.
4. Declare III class if the average is below 50% but 40% and above.
5. Declare FAIL if the average is below 40%.

In this problem we set up two counters, one for counting the passes and another for counting the total students. After processing each student we check whether the COUNT is

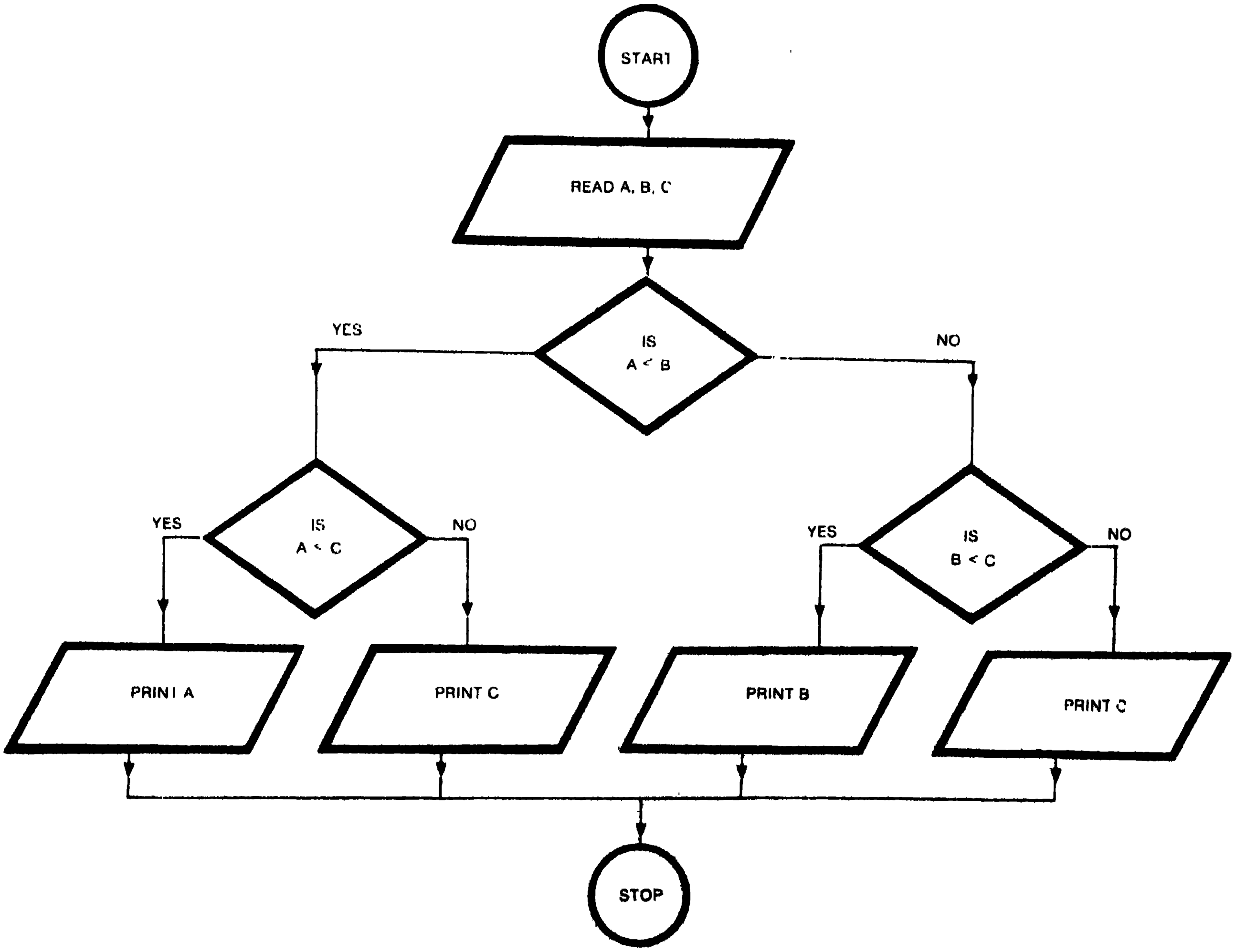


Fig. 3: Schematic representation of flowchart illustration 2.

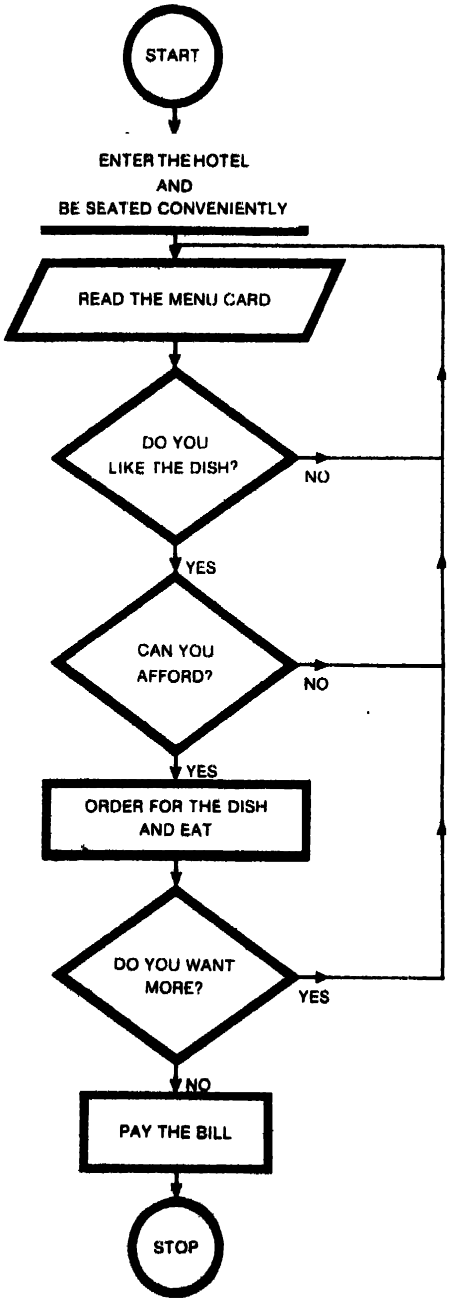


Fig. 4: Schematics of flowchart illustration 3.

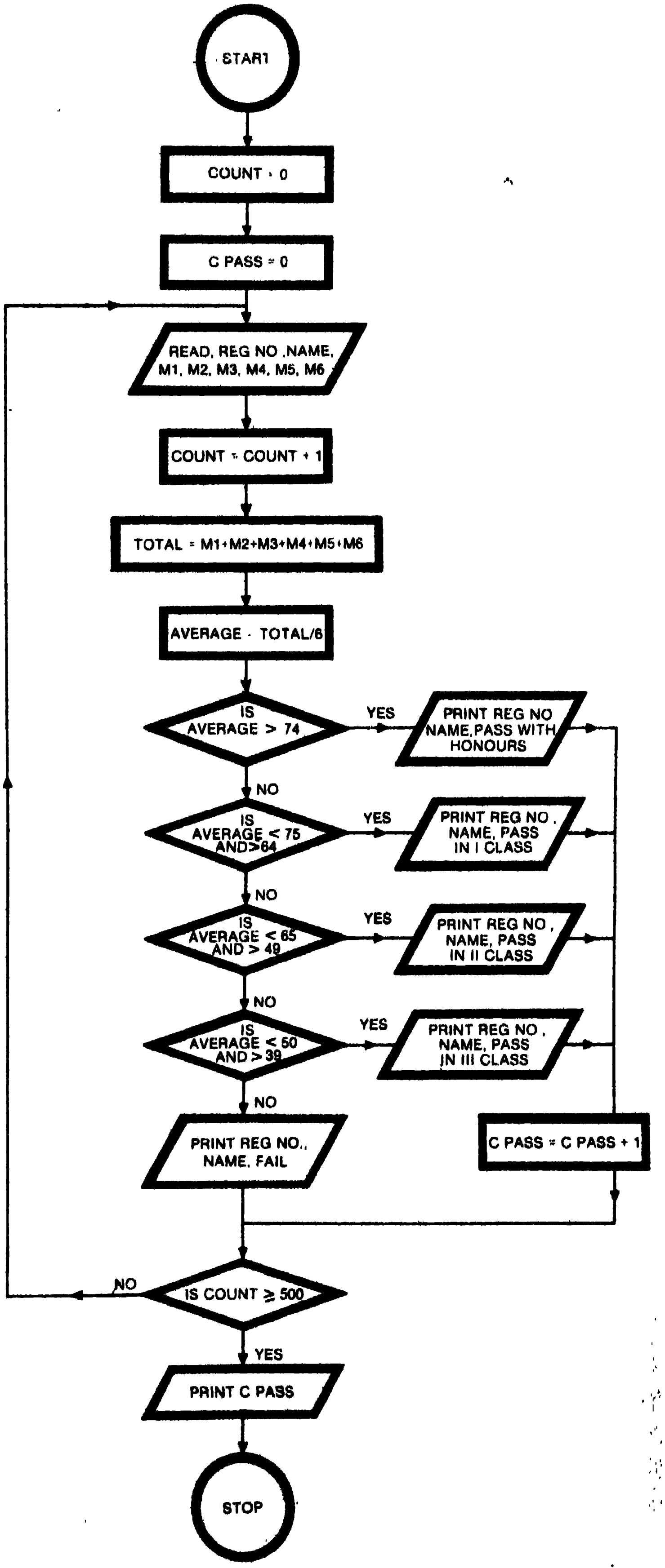


Fig. 5: Schematic of flowchart illustration 4.

less than 500 If it is so, we go to process the next student, otherwise we stop the operations after outputting the count of successful students. Carefully follow the steps shown in Fig 5 and see how the objective is achieved.

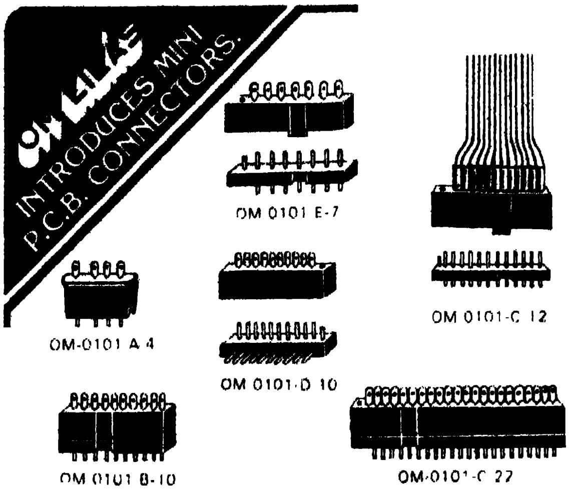
Summary

Deriving the algorithm is the first and the foremost step before preparing any problem for computerisation. This process involves the splitting of the problem into smaller ones and finding the procedure for solving the smaller ones. This is nothing but a commonsense approach for solving complex problems. This is the famous 'systems approach' for solving problems which is based on the philosophy: 'when the foe is formidable, divide and conquer'.

Next, one must try to represent the different steps pictorially by what are called flowcharts. Flowcharting is an important technique used by programmers to analyse and depict the logic of a computer problem. Its importance cannot be over emphasised. Very many complex logic can be easily resolved if one tries to analyse it with the help of flowcharts. Writing computer programs for problems will become very comfortable if one has prepared the correct flowchart

Algorithmising and flowcharting are the two important ways of analysing and organising a problem for computer implementation

(To be continued)



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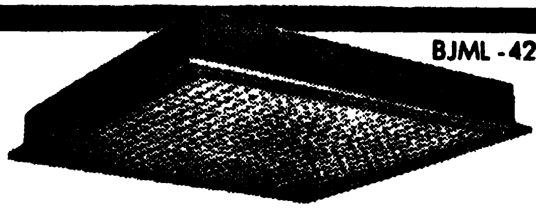
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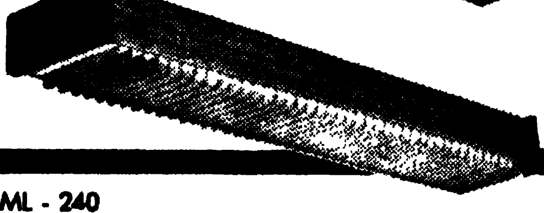
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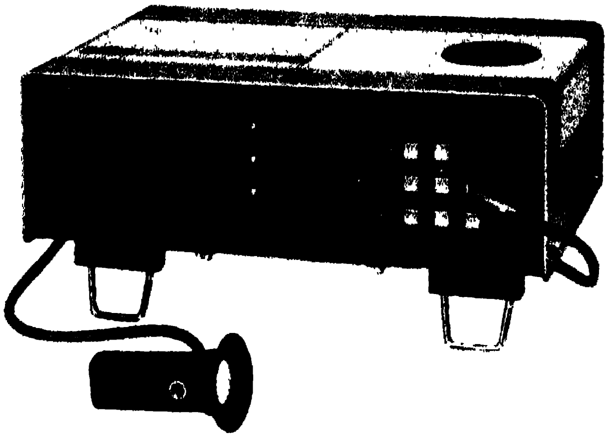

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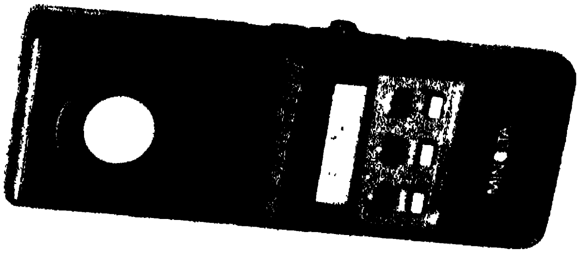

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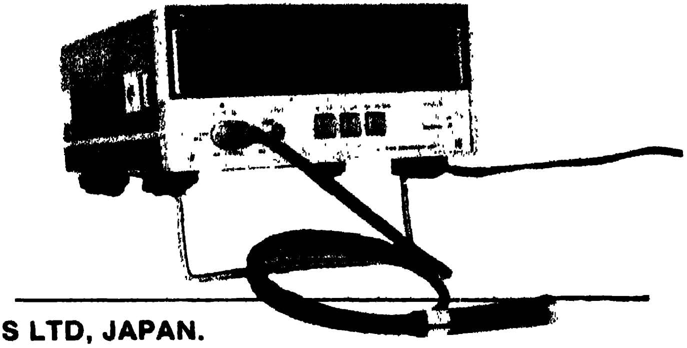

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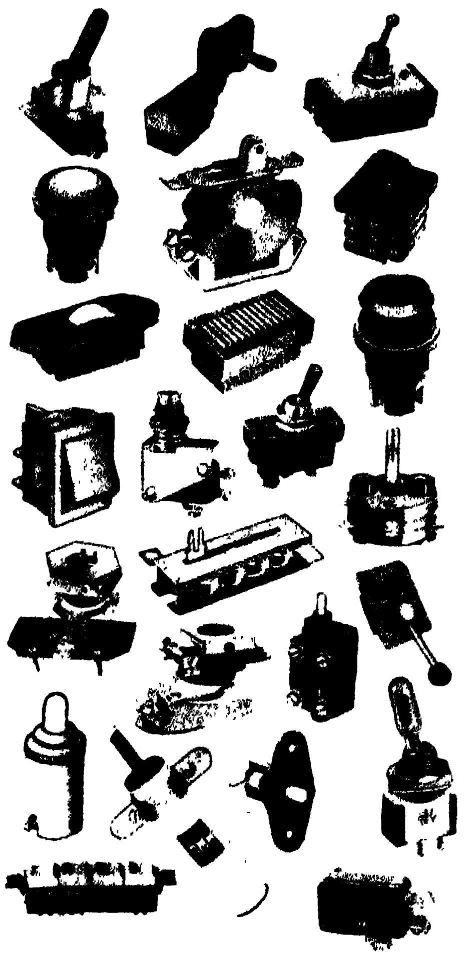

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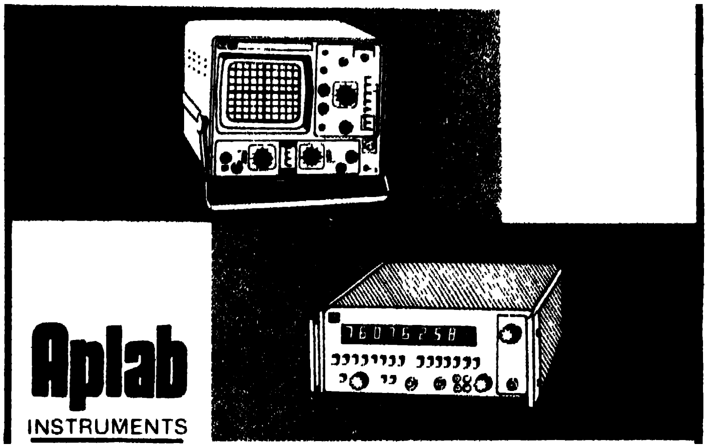

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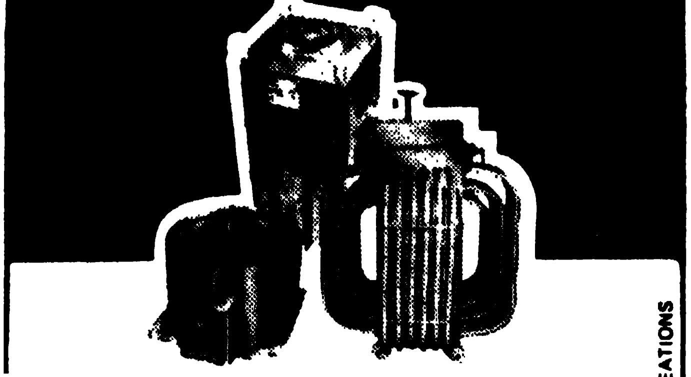

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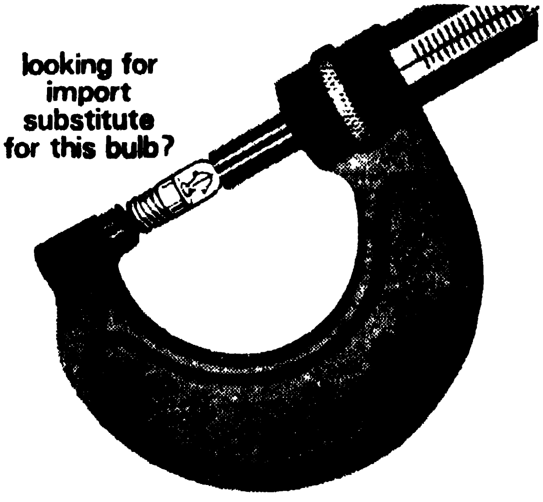

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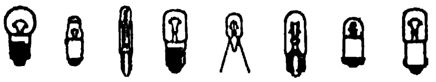

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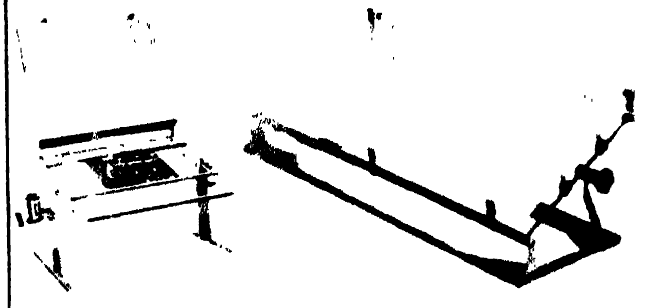

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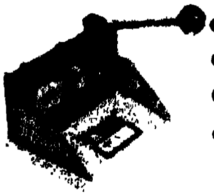

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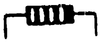
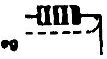
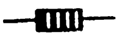
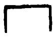
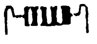
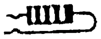
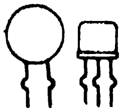
Standard Kit - Cut and Bend	
Standard Kit Produce vertical mounting by bending over long leg	
Standard Kit - Cut to Length	
Jumper Link Kit	
Stress Relief Kit	
vertical Stand Off Kit	
Transistor / Capacitor Spread Cut and Form Kit	

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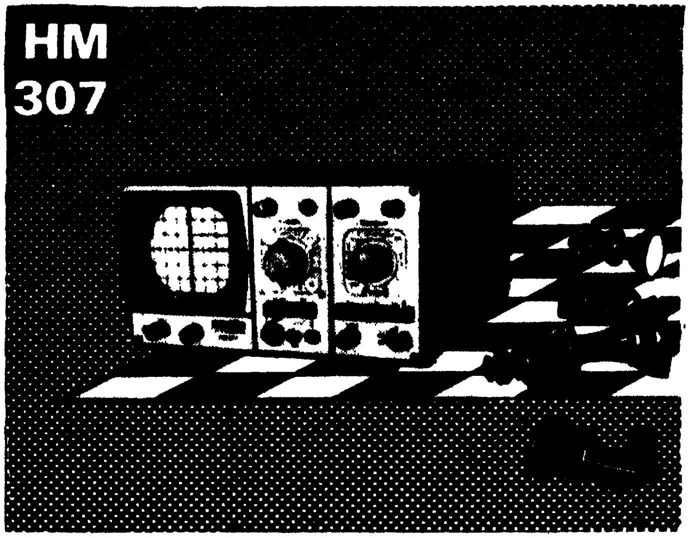

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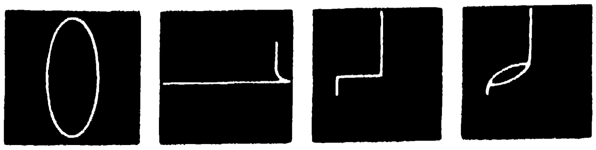

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Op-amps have gained respect for their high quality and the varied range which covers many applications in the vast field of electronics. Whether the feedback is linear or non-linear, resistive or reactive, op-amps are bound to function in their specified set of rules.

A logarithmic amplifier in Fig. 14 uses the base emitter junction of a transistor in the feedback loop. The principle of operation relies on the logarithmic relationship of the base emitter voltage and the collector current of the transistor. A log amplifier is non-linear so that a large input variation produces only a small output variation.

A number of supporting steps are necessary to ensure that the operation carries on unambiguously. First of all, the characteristics of the transistor must lie in the desired log structure. High frequency compensation is often necessary for which a capacitor of proper value across the feedback device will serve the purpose. To counter the practical possibilities of input polarity reversal, which is very unpleasant for the transistor in the feedback path, a protective diode is inserted here. If all the functional refinements are completed, the feedback element governs the output of the system.

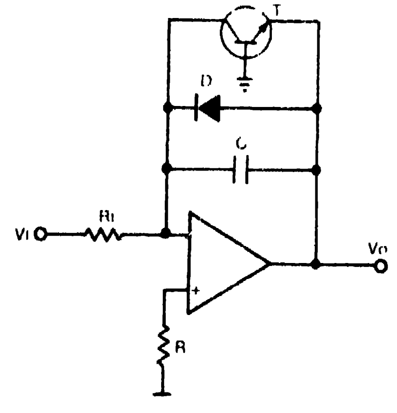


Fig. 14: A logarithmic amplifier using transistor in the feedback loop.

A reactive element in the leading feedback path of an amplifier implies that the system is frequency dependent. A typical example is an integrator or integration amplifier. The output voltage of such an amplifier is inversely proportional to the time constant of the feedback network and directly proportional to the integral of the input voltage.

The circuit in Fig. 15 can be used for a wide frequency range application. The intermediate frequency of the system is set by the values of R and C, while the high frequency range is fixed by the feedback capacitor Cf and R. Resistor R1 provides DC feedback so that the offset voltage cannot continuously charge Cf, thereby leading it into the limiting point. However, R1 may have the effect of limiting the gain of the op-amp at very low frequencies. If the input offset voltage of the op-amp is very low, the non-inverting input can be connected to the ground through a fixed resistance of value close to resistor R.

Recently, there has been an extraordinarily heavy emphasis on CMOS technology due to the availability of complementary P-channel/ N-channel transistors in the monolithic form. For example, 74C04, a CMOS inverter gate, can be used as an amplifier with the help of proper negative feedback. Due to the symmetry of P- and N-channel transistors, negative feedback around the complementary pair develops a self-bias of approximately half the supply voltage. Now the system behaves as if it is biased for class A operation.

Under AC conditions, a positive going input will cause the output to be a negative going variation and vice versa, providing an overall inverse effect. One of the outstanding properties of this arrangement is that it can operate at a very low voltage (3 volts) if the input frequency is below 1 kHz. At about 5V, the frequency range extends to 1 MHz within a possible gain of about 30 dB. The major drawback, of course, is the singing of the output voltage, especially when it approaches the supply level. At present this scheme is used in cases where distortion is not critically significant.

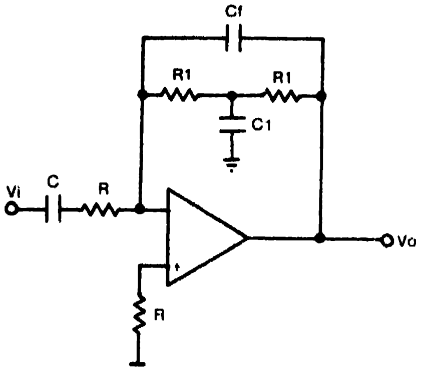


Fig. 15: An integration amplifier can be used for a wide frequency range applications.

Positive feedback

As the system status moves away from the point of normality, deeper into the danger area, there appears a finite possibility that the system will acquire a status of irreversibility. In engineering jargon it is 'catastrophic failure' and in physiological terms it is 'death'. Both these mean a continuous snowballing of excessive parameters leading to a complete loss of function, an obvious result of indiscriminate positive feedback into the system. One should note that in such cases there is no appreciable time lag in feeding back the information within the given frame of reference.

It is interesting to speculate on the role of the factor 'gh' when it lies in between 0 and 1. When it assumes zero value, the system escapes from the burden of feedback of any kind into carefree open loop formation. In this case, the sole authority is 'g', the open loop amplification factor. Any increase in the product 'gh' with identical polarities for both 'g' and 'h' will create a positive feedback. Clearly, the system succumbs to the positive feedback or regeneration by which the closed loop gain shoots up. It reaches infinity or saturation when the product 'gh' equals unity. Some of these properties raise a host of fascinating possibilities.

Frequency selective feedback makes the factor 'h' a function of frequency. Obviously, the signal which is fed back must be in phase (or any integral multiple of 360°) with the input signal to secure regeneration. If the factor 'gh' is close to unity where the close loop gain seemingly assumes infinity, the output of the system will no longer resemble the input signal.

In the strict sense, the system does not require any external input, but it is capable of functioning on its own, replacing the external inputs with the feedback signals. At a frequency decided by the feedback networks, the factor 'gh' falls to zero, forcing the system to go into its open loop set up. This happens at the mid-frequency of the network when the phase angle undergoes 180° phase shift, which together with the presently introduced phase shift of the amplifier makes a total phase shift of 360° and the amplifier output starts tracking in the opposite direction. Hence, even if the frequency of operation of the amplifier is different, it will be forced to operate in and around the frequency of the feedback network.

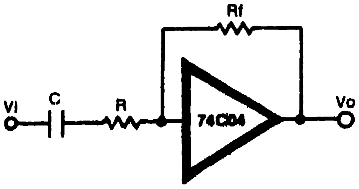


Fig. 16: An amplifier using a CMOS inverter gate with negative feedback.

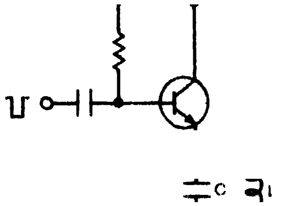


Fig. 17: Shock-excited oscillators for damped sinusoids on excitation.

But things are not as rosy as they appear to be. If the factor 'gh' is less than unity, each succeeding cycle of the feedback from the output will be less than the previous feedback quantum. Eventually, the oscillations will damp or decay and disappear. Shock-excited oscillators, like the one in Fig. 17, provide damped sinusoids on excitation. As soon as a negative voltage is applied to the base, the collapsing magnetic field around the inductor charges the capacitor. However, the oscillations developed because of this decay rapidly due to loss of energy in the resistance.

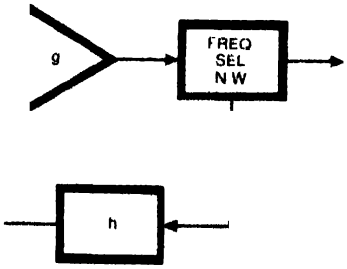


Fig. 18: Block diagram of a Wien bridge configuration.

If the factor 'gh' is greater than unity, the oscillations will tend to grow until a saturated equilibrium state is reached. With the help of specific feedback devices, oscillations like triangular waves, sawtooth waves or waves of other interesting forms can be generated. This is, of course, of inestimable value in digital applications.

The Barkhausen stability criterion, proposed in 1919, lays emphasis on the loop gain of slightly greater than unity for a sustained oscillation. This abstract point of view became more prominent in the later developments. A clearer persperctive emerged mainly by the work of Appleton and Van der Pol in 1926. Starting from relaxation oscillators and multivibrators, a new genre of electronic circuit technology developed in the area of such applications as time base, counters, waveform generators and logical circuits. The main concern was the frequency stability and its range. The principle of harmonic balance introduced by Groszkowski in·1933 led to the development of numerous oscillator circuits bearing the names of their inventors.

Logically, the first problem arising in this field is the one of frequency selective networks which are capable of discriminating frequencies very sharply. A frequency selective feedback path makes the factor 'h' a function of frequency. Several such frequency selective networks are available in the world of electronics

Wien bridge (sometimes called Wien-Robinson filter) is considered to be one of the most reliable networks to provide a feedback path. It allows one-third of its input voltage to appear at its output. At its mid-frequency or centre frequency (which is the reciprocal of 6.28RC for a symmetrical network), the gain of the loop drops to zero. By selecting proper R and C values it is possible to suppress a predetermined frequency range.

One of the weaknesses, often recited in Wien bridge is that the voltage is not referred to a common ground, rather it is taken from the mid-points of the leading branches as in the case of purely resistive wheatstone bridge.

Another interesting aspect is its phase angle relationship with the input and mid-frequency. Phase angle of its output continues to increase negatively as the increase in its input

Complex Numbers

One question usually asked in high school algebra classes is the root of the equation $x^2 + 1 = 0$. Indeed, it looks simple, but there is a catch in it. It is a fact that there is no real number which can satisfy this equation, rational or irrational. Needless to say, there are a great many practical situations where a system is better explained with such equations. Evidently, a mere collection of rational and irrational numbers would not be efficient enough to establish functional relationships in many systems. What do you make of this grim riddle?

School boys would heave a sigh of relief when you say that the root of the above equation is an imaginary number, another gerund in the mathematical language. By the law of signs, (+k) multiplied by itself is k^2 and so is (-k) multiplied by itself. This is why a number which on multiplying itself gives a negative sign is branded as an imaginary number. Playing with riddles like the one we have just seen, we get a number which when multiplied by itself gives (-1). For us it is easy to grasp the number with a direction attached to it, such as positive k and negative k or so-called image or back numbers. The mystification of imaginary numbers ends when we are ready to accept the roots of negative numbers as we do in the case of positive numbers.

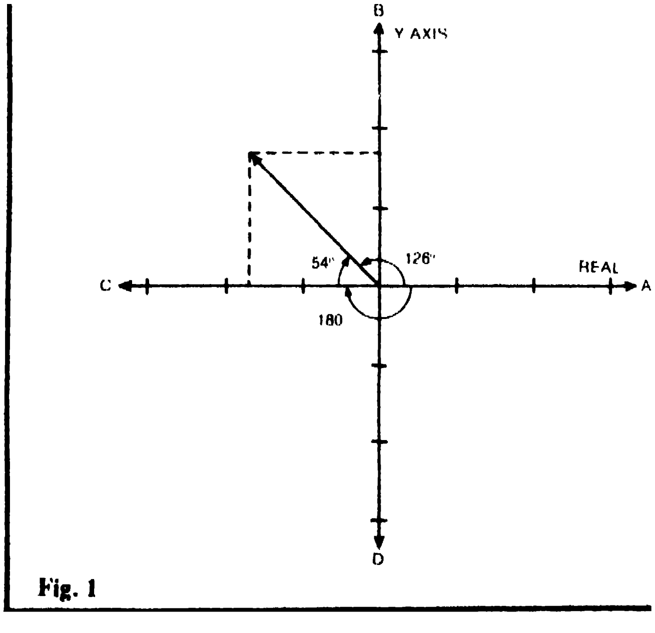


Fig. 1

Assume a semicircle with its diameter passing through the origin of a Cartesian coordinate system. Any perpendicular drawn from a point on the circumference to the diameter will create two right angled triangles within the semicircles. Now, according to elementary geometry, the distance OC equals to the square root of the product OA and OB. If the origin is so situated that the negative side is 5 units and the positive side is 1/5 units, then the height OC equals to the imaginary number, square root of (-1). On the contrary in Euclidian geometry, the sign of OA is ignored and the height OC is expressed only in magnitude.

There is a reflex to identify electrical parameters in terms of pure positive numbers. This ability to ignore what is highly unlikely is a part of our heritage. It is an easy way of concluding the situation quickly and with utmost (never definite) probability. Electricity does a lot of commendable work which is easily perceptible so we do not normally speculate on its intermediate parameters. In fact the function of electronic devices cannot be fully explained in terms of a set of positive real numbers owing to the frequent partnership of real parameters with imaginary numbers.

Euler, an eminent French mathematician who lived centuries ago, introduced the symbol 'i' with a property $i_2 = -1$. This was the auspicious beginning of a new vista of numbers called complex numbers. The versatility of 'i' is so great that it has repeatedly been used by scholars like Gauss, Cauchy, Rieman, Hailton and so on. The accepted outfit of a complex number is (a+ib), where a and b are real numbers. The new born 'i' enjoys a piggyback ride on the coefficient b. Of course, we need not tax our imagination regarding a, the real part of the complex number.

When it comes to electronics, the symbol 'i' would not be a unanimous choice at all, since it has long been recognised as a representation for current. For convenfrequency, until it attains the characteristic mid-frequency. If the input frequency is exactly equal to the mid-frequency of the network, the phase angle undergoes an abrupt reversal from negative 90° to positive 90°, from where it continues to decrease with the increase of the input frequency.

In twin-T filter (sometimes known as double integration selective filter), similar (not identical) characteristics in phase and frequencies are cited. However, because of the common ground for both input and output, twin-T has an edge over the other. The common feature is the increased reliability at low impedance levels.

A symmetrical Wien bridge sinusoidal oscillator is shown in Fig. 20. The resistor-capacitor combination provides a positive frequency selective feedback path around the op-amp, while the resistor 'r' together with an incandescent lamp sustains a negative feedback. The positive feedback is extremely dominant in the circuit operation, since it causes the circuit to oscillate sinusoidally.

The resistor 'r' is normally kept slightly less than twice the resistance of the lamp, so that the closed loop gain is greater than unity. When the amplitude of oscillation increases, the lamp gets heated up, thus increasing its resistance. In the absence of this or a similar arrangement, the system will enter into its non-linear state, introducing distortion. The lamp helps to regulate the amount of negative feedback stabilising the amplitude of the sinusoidal output.

Another protective measure often employed in oscillators is the use of negative feedback. This is highly desirable in op-amps, since in open loop conditions, or when the factor 'gh' approaches unity, the op-amp gain will cause its output

---

ience, this imaginary number 'i' in mathematics is changed into 'j' the next letter in the alphabetical order though it possesses all the properties of the symbol 'i'. Now, the complex number can be represented as (a+jb), where 'jb' is the imaginary part.

The use of mathematical gerund or operator 'j' in Cartesian coordinate system provides a visual indication of the phase of the potential difference across the reactive and resistive elements. The convention adopted for this is that along OA and OC the positive and negative real parts (which are equivalent to $(-j^2)$ and $(+j^2)$ respectively) are scaled while along OB and OD the operator 'j' takes its positive and negative states respectively. The impedance, current or voltage can now be represented in this complex plane.

It is customary to write a complex number in polar form, as $V = k\angle\phi$, which means that V equals k at an angle of ϕ. If we take $V = a + jb$, then $k^2 = a^2 + b^2$ and $\tan\phi = b/a$.

For example, if $V = -0.9 + 1.2j$, it lies in the second quadrant since its real part is negative and complex part is positive which only the second quadrant can satisfy. Then $V = 1.5\angle126°$. (This is elucidated in this way, $(1.5)^2 = (0.9)^2 + (1.2)^2$, $\tan\phi = 1.2/0.9 = 1.33$ or $\phi=54°$. The angle in the anticlockwise direction is equal to $180°-54° = 126°$ (Fig. 1). Similarly, $Z = 32 + 55.4j$, corresponding to $Z = 64\angle60°$.

According to Euler's theorem, a complex quantity of magnitude 'k' making an angle ϕ with real axis can be expressed in exponential form, as $(ke^{j\phi})$, which is equivalent to $k\angle\phi$. This is very important in the field of electronics because of the simplicity in multiplication and division of the quantities in polar or exponential form. However, addition and subtraction of the polar or exponential forms are extremely tedious. Complex numbers are expressed in rectangular form for the process of addition and subtraction. The quantity $V = a + jb$ in rectangular form is equal to $V\angle\phi = k\angle\phi$ in polar form and $V = ke^{j\phi}$ in exponential form, where $k^2 = a^2 + b^2$ and $\tan\phi = b/a$.

Now the product of (0+j) with, say, $3\angle60°$ equals to $(1\angle90°)(3\angle60°) = 3\angle\underline{90+60} = 3\angle150°$, while their mutual division gives $3\angle\underline{90-60} = 3\angle30°$. This is the reason why the operator 'j' is often referred to as the operator that rotates a line in the complex plane by 90°.

In LR or CR circuits the voltage and current may not be in league with each other. Their cohabitation is influenced by the frequency of operation. This can be investigated by using a vectorial representation of the total opposition in the network which is a specific combination of resistance (real or in-phase component) and reactance (imaginary or quadrature component).

In LR circuit the total opposition or impedance is $Z = R + jwL$, where w is the angular frequency (6.28 multiplied by the frequency in Hz) and L the inductance in 'henry'. See how the imaginary part takes leave of the circuit at zero frequency or in DC.

For example, a 100-ohm, 100-microhenry circuit operating at a frequency of 100 kHz has an impedance of 118 ohms but offers 636 ohms at 1 MHz and reaches 100 ohms at zero frequency. This impedance lies in the first quadrant and is equal to $118\angle32°$ while it is $636\angle81°$ at 1 MHz frequency. If we multiply the parameters with current, we get the potential difference across the resistive and the reactive components. This shows that the potential difference across the impedance leads with respect to the real or in-phase components.

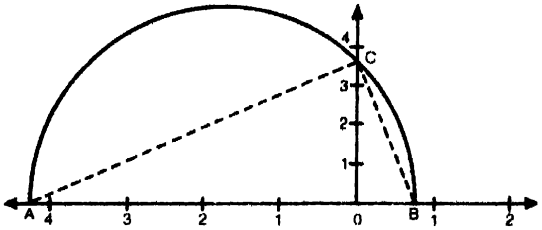


Fig. 2

In a CR circuit the impedance is similarly defined, which is equal to $Z = R + 1/jwC$ or $Z = R - j/wC$. The negative j, here, brings the impedance in the fourth quadrant. For example, a 1k, 0.1 μF circuit operating at 1kHz offers an impedance of $1880\angle328°$, or $1880\angle-32°$. If we multiply the parameters with the current in the circuit, we can see that the voltage lags behind by the same angle with respect to the real or in-phase component.

It is significant in complex representation that the real and complex parts are absolutely independent of each other. Thus the complex number (a+jb) equals to (c+jd) only if a=c and b=d. This is visible in the above example where the parameters were different and possessed the same phase angle in magnitude but were in different directions.

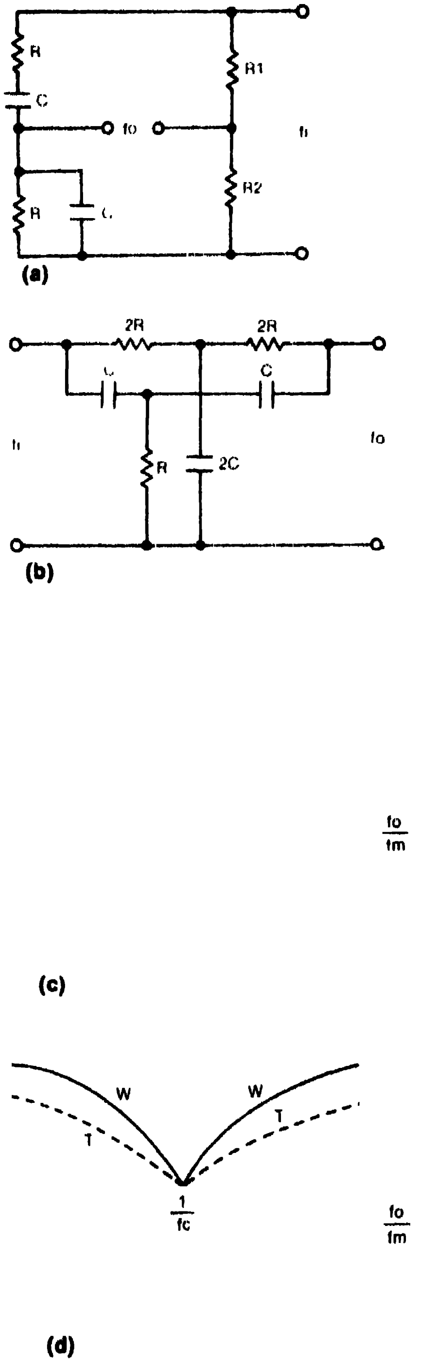


Fig. 19(a): Wien bridge configuration; (b) a twin-T network; (c) phase angle relationship with input and mid-frequency in case of Wien bridge; and (d) the relationship in case of twin-T network between phase and frequencies.

to latch on to the supply voltage level, thereby introducing heavy distortion. A well designed negative feedback around the op-amp fulfilling the requirements of the specific frequency selective network has a tendency to stabilise the amplitude and linearity of the output of the system. This type of oscillator is also called multiple feedback oscillator.

In many systems the manner in which the oscillations begin is slightly obscure. The nagging problem in the initial stages of operation is that the positive feedback needs some input to begin with. However, it is easier done than said. Any minute discrepancy in the amplifier symmetry will result in some output which is more than sufficient for the rest of the operations. In most of the cases, it is more difficult to stop the oscillations than to start them, if all other conditions are favourable for oscillations.

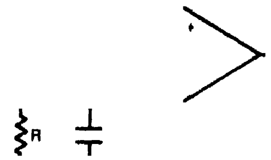


Fig. 20: A symmetrical Wien bridge sinusoidal oscillator.

Another classic example of multiple feedback oscillator is the twin-T sinusoidal oscillator. Here a double integration technique is employed in the frequency selective feedback path. Behaviour of the twin-T is similar to that of the Wien bridge, except for the common ground facility. The time period of centre frequency is equal to 6.28RC as in the case

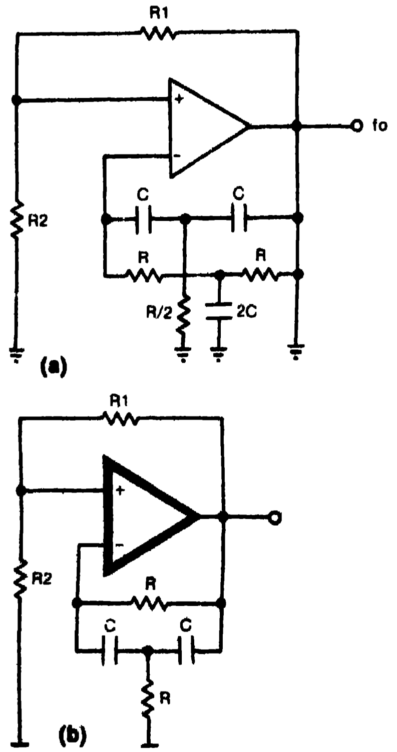


Fig. 21(a): Twin-T sinewave oscillator; (b) sinewave oscillator with single-T feedback network.

of Wien bridge oscillator. When the network is balanced, it acts as a frequency dependent attenuator giving zero output at its centre frequency.

Another striking result which emerges from the architecture of oscillators is the concept of the negative resistance. The live stock operators of the oscillator are lined up so as to project this formidable image. If an inverting amplifier as in Fig. 22 with equal resistors 'r' in the negative feedback path is considered, the gain of the system is clamped to 2. Now the input voltage Vi will appear as 2Vi at its output. Introducing a resistor R from the output to the input to provide a positive feedback, the input current from the source is virtually divided by R. In other words, resistor R will develop a voltage Vi so as to oppose the input voltage. However, the total voltage from the output to the ground appears as 2Vi.

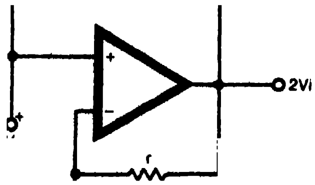


Fig. 22: An inverting amplifier with equal negative feedback resistor.

As far as the source is concerned, the system has a negative resistance equal to R. In principle, the losses in an oscillatory circuit due to heat and radiation, especially at high frequencies, should be minimised. The heat loss or I^2R loss could be reduced to zero or made negative since I is the rms current. This requires that power should be fed to the circuit in some way so that losses due to resistance of the network are overcome.

The phenomenon of synthetic negative resistance is invariably present in a majority of the sinusoidal oscillators and function generators. Negative conductance and resistance are observed under static conditions as well as under dynamic conditions. Since negative resistance circuit elements are always non-linear, the term 'dynamic negative resistance' has greatest significance when defined in terms of the ratio of fundamental components of current and voltage.

A negative variation of conductance implies that a negative increment of current flows in opposition to the positive increment of the voltage that causes it. This means that a negative conductance circuit must always have a power source associated with it. Although various negative resistance effects such as arc discharge, dynatron etc have been known for many years, practical devices simulating negative resistors became available only with solidstate devices and their combinations.

A close inspection of oscillators like Hartly, Colpitts, Clapp, Franklin, Pierce, Meissner, Reinartz, phase-shift etc reveals a similar basic principle of oscillation realised through different means. In all these oscillators, the frequency determining network has stable phase characteristics with a sharply resonant centre frequency. Around the centre frequency there is a rapidly changing frequency response. Freedom from non-linearity, instability, distortion and load variations are the focal points in the selection of an oscillator for a given application from the above mentioned multitude of oscillators.

Although the oscillator circuits described here are designed within the specifications laid down by the theoretical model, they are still unstable for a variety of reasons. Obviously the instability in oscillators is moulded by the reactive elements which may not have a constant phase shift as assumed. By presuming somewhat ideal conditions, one can define the stability factor for an oscillator in terms of its sensitivity to the amplifier phase shift. In a majority of oscillators (one notable exception is the phase-shift oscillator), the stability factor is directly related to the open loop voltage amplification, thus hinting at a further instability due to variations in open loop gain. Supposing that the open loop gain is a constant, one can prove that the stability is maximum for twin-T (0.5g) followed by bridged-T (0.45g and then the Wien bridge oscillator (0.25g).

Voltage regulators with positive feedback are not new. The circuit shown in Fig. 23 is a bistable system with two possible states—Vz the zener voltage and Vd the contact potential of the zener diode. However, the latter state is difficult to acquire, as a result of the presence of positive voltage across the zener due to diode D. When the system is just turned on, the zener voltage is less than Vz and the current through the zener is negligibly small. But very soon rapid regeneration would follow at a rate set by the ratio R2/R1. Moreover, the voltage across the positive feedback resistor is negligible due to the lack of current through the zener, i.e. the output voltage is equal to the voltage across the zener. The process of regeneration stops abruptly, as soon as the zener starts conducting, which provides a reference voltage to the amplifier.

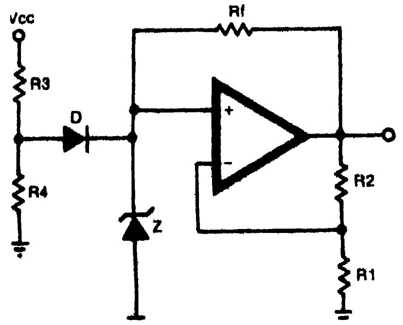


Fig. 23: Voltage regulator with positive feedback.

Another modifier of temporal relationship in the positive feedback system might be called 'hysteresis'. The response

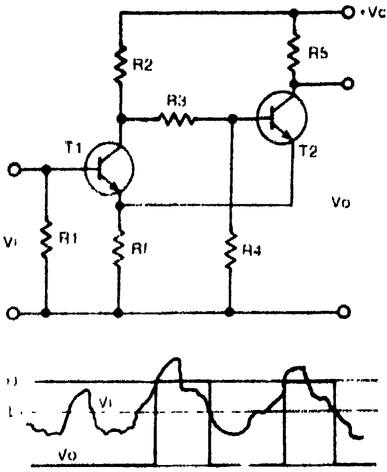


Fig. 24: A basic schmitt trigger configuration.

depends on the direction of change and previous values of the input but not on its rate of change. This corresponds to the hysteresis property found in magnetic materials. Different turn-on and turn-off threshold points in a hysteresis structure leads to a highly predictive action for continuously varying smooth signals. Signal storage due to hysteresis is independent of storage time. In physiological terms it is an 'all or none' response since the signal is either obtained at full amplitude or not at all.

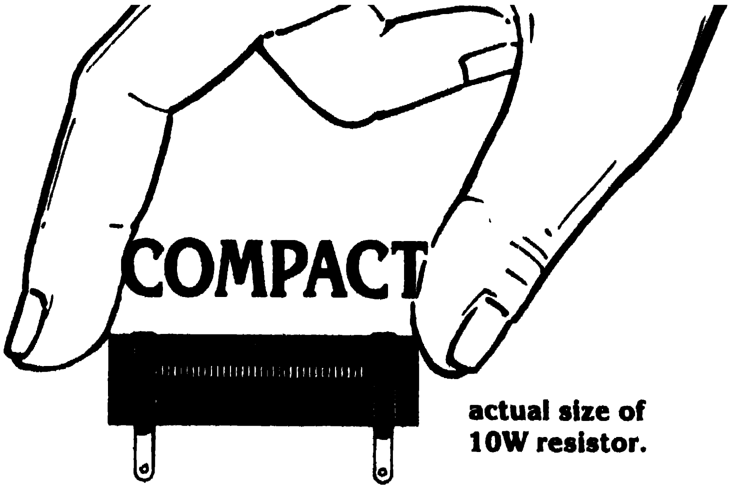
The circuit shown in Fig. 24 is a basic schmitt trigger configuration. Consider the situation when the input to T1 is equal to zero. The forward bias provided by the potential divider R2, R3 and R4 facilitates T2 to conduct. The positive voltage across Rf prevents T1 from conducting while T2 is held slightly below saturation.

When the input voltage is increased to the level of the base voltage of T2, T1 starts conducting. The collector voltage of T1 falls rapidly by the positive feedback between the emitters, ultimately changing the status of both the blocks.

Here, it is a mutual exchange of system status at a much faster rate because status is always away from saturation. Due to hysteresis, the system does not retrace the steps as soon as the input signal crosses the threshold or trip point. A wide range of digital building blocks exploit this property of positive feedback.

Devices like SCR, UJT, triac etc, from the family of high speed switches can be considered as a combination of two or more amplifiers for example, SCR has two transistors interconnected to form a positive feedback pair. Once a signal is applied to the gate (base of the transistor T1) just above the threshold level, an avalanche of regeneration occurs due to the excessive gain of the individual blocks.

(To be concluded)



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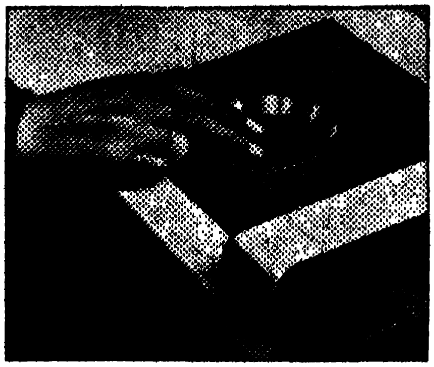

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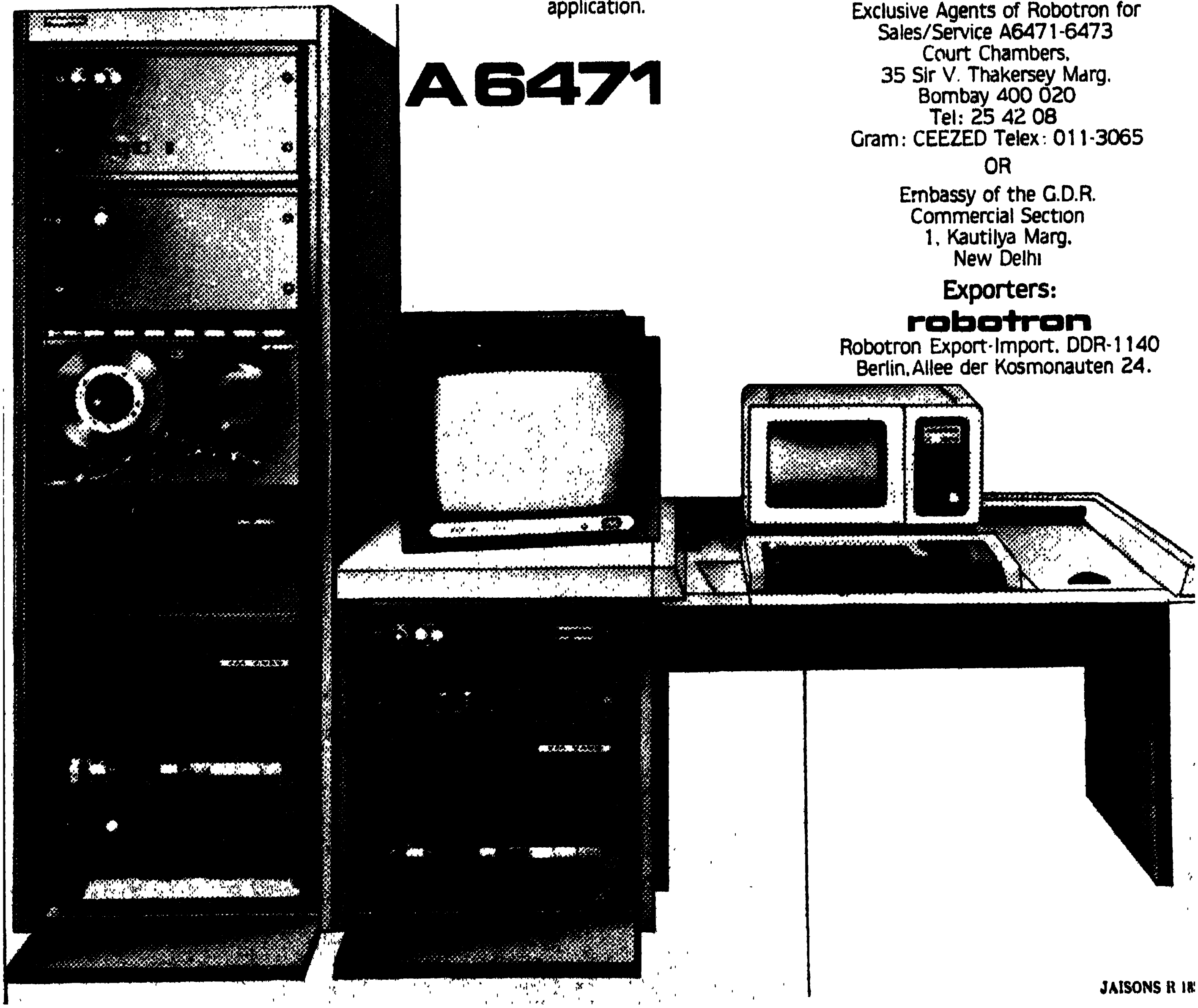

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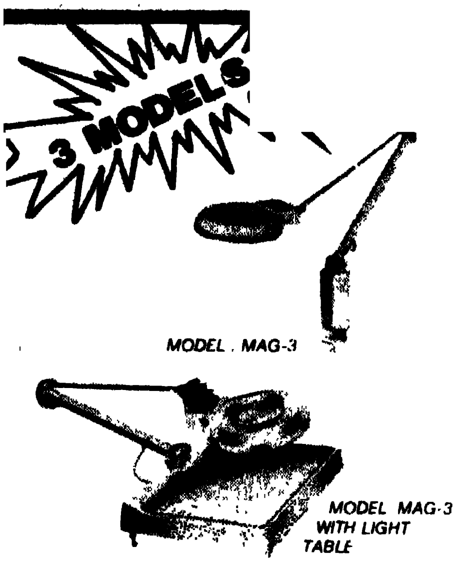

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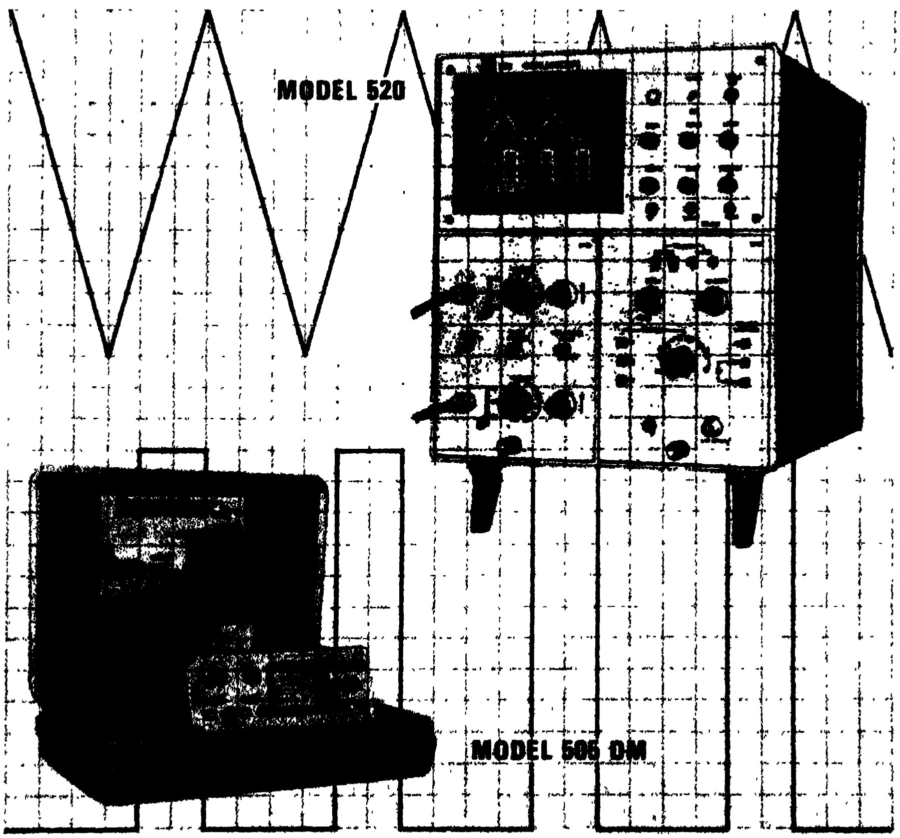

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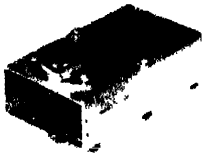

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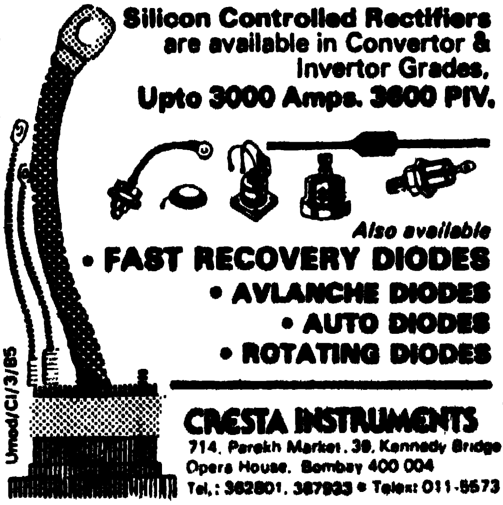

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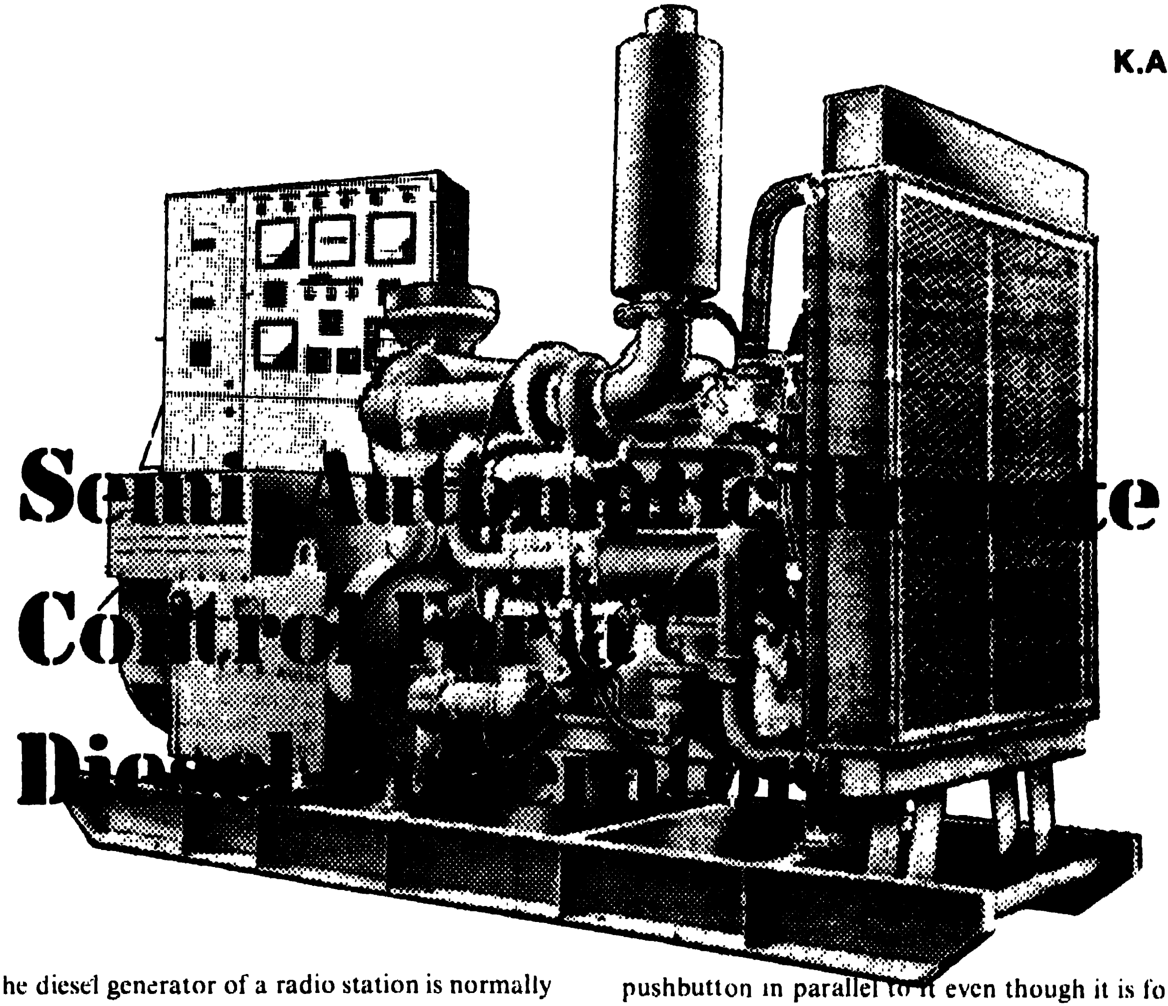


Semi-Automatic Remote Control For The Diesel Generators

The diesel generator of a radio station is normally installed at a place far off from the control room. In case of power supply failure, which is very frequent in some areas, it is a laborious and time consuming process to go and switch it on and then to switch it off. If the transmitter is powered by diesel generator, then the delay in switching on the generator results in prolonged service interruptions.

At most of the stations, it is observed that only remote starting facility is provided by just putting a parallel pushbutton. Since the stop operation is not remote, there is an inherent delay in switching off the generator due to obvious reasons, resulting in wastage of fuel.

In order to eliminate the delay in switching on and off and also to reduce the wastage of fuel and time, it is necessary to have the provision of both start and stop operation of generator from remote. In almost all the diesel generators, a starting pushbutton switch is provided. A very heavy current flows through this pushbutton in order to operate the starting solenoid. Moreover, the generator does not start with a momentary push of a button. Instead, it is necessary to keep the pushbutton pressed for at least 2-3 seconds.

Therefore, it is not desirable to provide a remote starting pushbutton in parallel to it even though it is found that at many places a parallel pushbutton is brought on the control panel. This requires a heavy-duty pushbutton, a heavy-duty battery cable and above all the battery gets discharged soon.

Stop operation in a diesel generator is not electrical. In order to stop the generator, the fuel supply cut off lever has to be pulled mechanically. The lever has to be kept pulled till the generator comes to a dead halt. If the lever is released before the generator comes to a halt, it picks up speed again and restarts.

Thus the stop operation is rather complicated. It is therefore not provided on the pretext that it is not necessary as the generator can be stopped at leisure, once the power supply restores. Obviously, this results in wastage of fuel.

Scope

An ideal system of remote control should have the following features.

1. Diesel generator should start with a momentary push of a button.

2. It should also stop with a momentary push of another button.

3. It should have an automatic cutout for the starting

solenoid. Otherwise, there is a possibility of the starting solenoid keeping the starting motor engaged with the generator for longer time and ultimately both the motor and the solenoid may get destroyed.

4. It should also have an automatic cutout for the stop solenoid. This is essential. Otherwise, the solenoid will burn if the supply is not disconnected due to some fault in the circuit.

5. Proper interlocking between the start and the stop pushbuttons should be there. This means that while the generator is off, stop pushbutton should be made inoperative. And also, when the generator is on, start pushbutton should be made inoperative.

6. There should be a remote/local switch on the generator panel in order to ensure the safety of the personnel working on the generator.

Generally, the changeover from normal supply to generator supply is made by an iron-clad switch. For remote control system, it is necessary to replace this switch by contactors of suitable ratings, and the control pushbuttons should be brought on to the panel near the start and stop pushbuttons. The main advantage of having contactors in place of switch is that, in case of power supply failure, after switching on the generator remotely, the changeover to generator supply can also be made instantly. An ideal system should also have an automatic changeover to generator supply once the generator is switched on and vice versa.

Before designing an actual circuit, the time required to start the generator after pressing the pushbuttons was noted and found to be about 2-3 seconds. The time taken to stop the generator after pulling the off lever was also noted and found to be about 8 seconds. It is to be noted here that this time varies with the capacity of the diesel generator (for 20kVA generator about 8 seconds are needed). Therefore, it was decided to provide an electronic time delay of 3 seconds for starting and 10 seconds for stopping.

Taking into consideration all the above points, a very simple transistorised circuit was designed, as shown in the diagram.

Refer the circuit diagram. Supply to the circuit is derived from the same 12V battery which is used for starting the generator.

Starting operation

Once start pushbutton S1 is momentarily pressed, capacitor C2 charges to approximately +7V, and transistor T1 is instantly driven into saturation, energising relay RL2 in its collector circuit. Capacitor C2 keeps providing base current to T1 through 10k resistor and hence T1 remains in conduction, keeping the relay energised even after the pushbutton is released.

But after three seconds, C2 does not provide sufficient base current to keep transistor T1 into saturation and hence it is pulled out of conduction and the relay in its collector circuit gets de-energised. The normally-open contact of the relay RL2 extends +12V to the dual-head lamp relay (RL4 and RL5) coils simultaneously. The start solenoid (RL8) gets supply through the normally-open contacts of RL4 and RL5a connected in series as shown. Thus the diesel generator starts.

After three seconds, relay RL2 gets de-energised and the supply to the solenoid is disconnected. Once the generator picks up speed and the output voltage becomes normal, relay RL1 also gets energised. This relay also interrupts 12V supply to the dual relays through one of its pairs of contacts. Coils of dual relays RL4 and RL5 have been energised and their contacts connected in series to extend supply to the start solenoid, in order to ensure positive tripping in case any one of the relays get stuck up. Relay RL1 with one of its pairs of contacts gives an indication of diesel generator 'on' condition by flashing an LED on the control panel.

Stop operation

For pulling the off lever, a 12V solenoid (RL9) is used. This solenoid is mounted on the generator in such a manner that it pulls the off lever completely, when it gets energised.

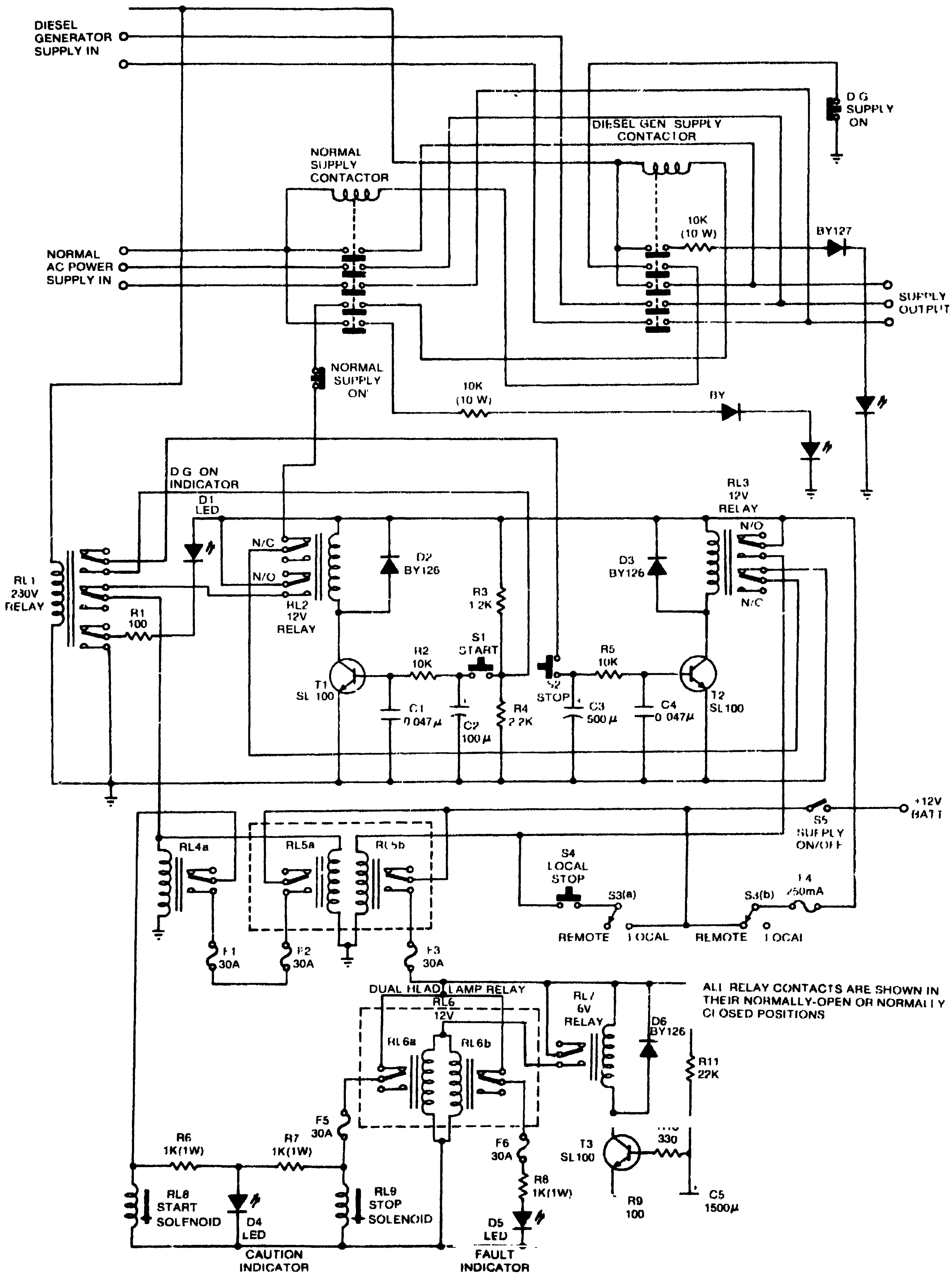
When the diesel generator is not running and the stop pushbutton S2 is pressed, transistor T2 does not get base drive, since the corresponding normally-open contact of relay RL1 is included in series with stop pushbutton. When the diesel generator is on, relay RL1 is energised. Now when the stop pushbutton is pressed momentarily, transistor T2 instantly conducts into saturation and relay RL3 in its collector circuit gets energised.

Capacitor C3 keeps T2 on, and hence the relay RL3 on, for about 10 seconds. With the normally-open contact of RL3, supply is extended to dual-head lamp relay RL5 to its 'b' coil. Thus with its RL5b contact, stop solenoid is energised and it pulls the off lever. Since relay RL3 remains energised for 10 seconds, and so does the dual relay coil RL5b, the solenoid keeps the off lever pulled for 10 seconds and the generator stops.

Stop solenoid protection circuit

Normally-closed contact of RL6a relay is inserted in series with the normally-open contact of RL5 relay in the stop solenoid circuit. Whenever diesel generator stop pushbutton is pressed momentarily, RL5b coil gets energised and +12V is extended to stop solenoid via N/C contact of RL6a. Supply is also simultaneously extended to stop solenoid protection circuit as shown and, therefore, capacitor C5 starts charging through 22k resistor (R11). After about 12 to 15 seconds, sufficient voltage is developed across C5 and hence transistor T3 conducts and actuates relay RL7 in its collector circuit. This 6V relay in turn energises coil of dual-head lamp relay RL6a and its contact is opened to interrupt the supply to stop solenoid.

But prior to the operation of RL6 relay, the supply to stop solenoid protection circuit is removed by contact of RL5b



ALL RELAY CONTACTS ARE SHOWN IN THEIR NORMALLY-OPEN OR NORMALLY CLOSED POSITIONS

Fig. 1: Circuit diagram of the semi-automatic remote control of diesel generator.

List of components required and their approximate price

S. No.	Name of components	Qty required	Rate per piece	Total amount
1	12V solenoid (Lucas made used in cars)	1 No	350	Rs 350.00
2	12V relay with two C/O contacts	2 Nos	10	20.00
3	6V relay	1 No	15	15.00
4	O/U/V relay (230V AC)	1 No	100	100.00
5	Dual-head lamp relay (type PMP 2103 used in car)	3 Nos	80	240.00
6	Miscellaneous (switches, pushbuttons, LEDs, PCB resistors and transistors)			100.00
			Total	Rs 825.00

All these items are available in the usual electronics shops in cities nowadays and their procurement should not be a problem.

after about 10 seconds. Therefore, RL6 relay operates only in case of faults such as welding of contact of RL5b or shorting of transistor T2. Relay RL6 operates under such faulty conditions and protects the stop solenoid from burning.

Whenever relay RL6 operates, red LED lights up via its RL6b contact, indicating the fault in the circuit. This LED is installed on the control console in the control room. The fault can be traced by switching off the battery supply by a rotary switch provided, as shown in the diagram. (Note: contact of RL6a relay is modified from normally open to normally closed.)

Caution indication

This indication (red LED) is also installed on the control console. Whenever the diesel generator is started or stopped, this indication comes as long as the start or stop solenoid is energised and persists as long as the solenoids remain energised. Caution indication appears for about two seconds whenever diesel generator is started and for about 10 seconds whenever diesel generator is stopped.

If this indication persists for more than the above stipulated period, it shows that the corresponding solenoid supply is through and it is about to burn. Operator should immediately swing into action under such circumstances and switch off the battery supply using the rotary switch provided on the diesel generator panel.

In short, this caution indication keeps a watch on both the solenoids and cautions the operator. But the possibility of this caution indication persisting is very remote since due care is taken to provide an automatic protection to both the solenoids while designing the circuit.

A remote/local switch is provided on the generator control panel. Before starting the work on generator, this switch has to be put in local mode so that nobody can start the generator from remote.

Stop pushbutton is also provided on the generator itself. This pushbutton is effective only when the switch is in local mode. This facility is provided to stop the generator by pressing the pushbutton instead of pulling the lever manually.

Normal/diesel generator changeover contactor system

As shown in the diagram, the coil circuit of the normal supply contactor is normally closed and hence normal supply is always through.

For changing over to the generator supply, it is necessary to first start the diesel generator and then press the DG supply on pushbutton. If the generator is not on, the changeover has no meaning and hence deliberately made ineffective, as is clear from the circuit.

In case power supply fails, diesel generator should be started by just pressing the DG start pushbutton. Changeover to diesel generator supply takes place automatically, once the generator attains full speed. This is achieved by including the normally-closed contact of relay RL2 in the diesel generator contactor coil circuit, as shown.

Also when the generator is switched off, the diesel generator supply is automatically changed over to normal supply. This is so since the normally-closed contact of relay RL3 is included in the diesel generator contactor coil circuit.

Following LED indications are provided on the control panel:

1. DG on indication (Yellow LED)
2. DG supply on indication (Yellow LED)
3. Normal supply indication (Green LED)
4. Caution indication (Red LED)
5. Fault indication (Red LED)

Salient features of the circuit

1. Starting operation: By momentary pressing the start pushbutton.
2. Stop operation: Also by momentary pressing the stop button.
3. Starting solenoid does not get supply in case start pushbutton is pressed by mistake when the DG is on.
4. Stop solenoid does not get supply in case stop button is pressed by mistake when the DG is not on.
5. In case of power supply failure, changeover to DG supply is automatic, once the DG is switched on.
6. Once the DG is stopped, changeover to normal supply is automatic.
7. Automatic DG supply changeover takes place only when DG attains normal speed and normal voltage.
8. Complete safety to start and stop solenoid, both automatic as well as manual, has been ensured.
9. Remote/local switch is provided on the DG panel, to ensure safety to the personnel working on DG.
10. Heavy start and stop current required for operation of solenoids, does not flow through the pushbuttons. Instead only 0.7mA of current at 7V flows through the pushbutton.
11. Moreover, the circuit draws a negligible current from the battery. ☐

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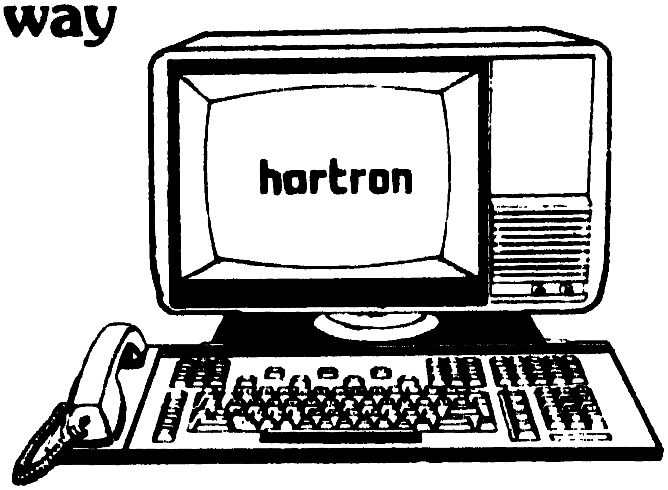

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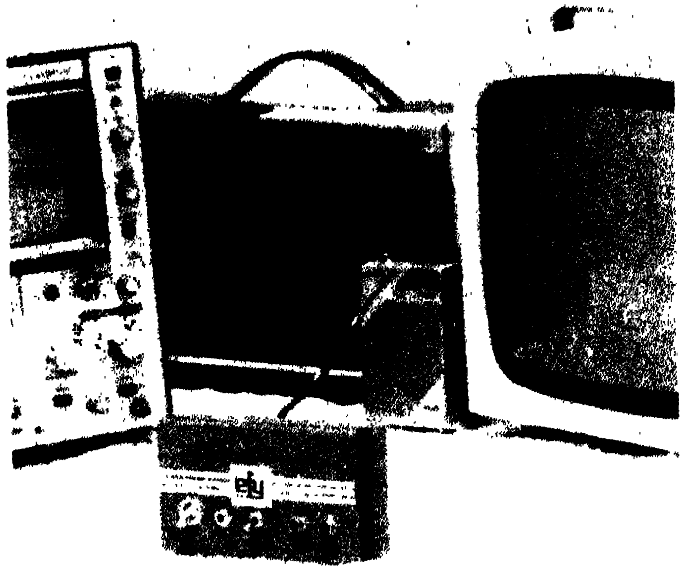
FM SIGNAL GENERATOR



Alignment of tuned circuits of a radio receiver is the most essential process required for perfect reception and reproduction of a signal to be received. Since the sound section of a TV receiver comprises a number of 'LC' tuned circuits, it also requires alignment. The FM signal generator described here would enable you to do this easily and perfectly.

In the signal generator, the frequency of an RF oscillator is modulated by the signal of an AF oscillator to produce an FM signal having a carrier frequency of 5.5 MHz. Whenever this modulated signal is coupled to the sound section of a TV receiver, the signal behaves as a 5.5MHz standard FM sound IF signal. So the generator can be used for testing the related sound sections in a TV. The generator has some additional areas of application also, which are covered later in the article.

Circuit details

The circuit for the signal generator is very simple. It comprises two oscillators. Oscillator 'A' is an RF oscillator oscillating at 5.5 MHz and 'B' is an 800Hz AF oscillator. The tank circuit of oscillator A, which determines its frequency of oscillation, comprises inductance L2, capacitance C3, C4 and a variable capacitor C5. A variable capacitance diode (varicap) or varactor (BB105) is also included in the tank circuit through a large capacitor (C6).

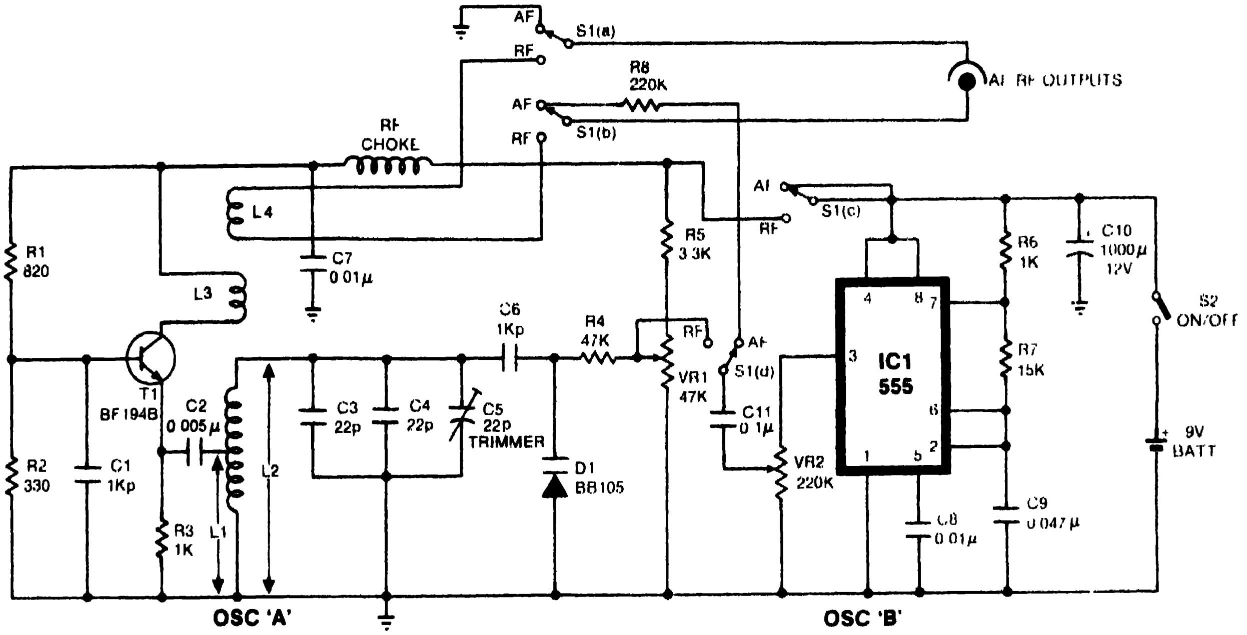
To modulate the frequency of oscillator A, output of oscillator B is coupled to the tank circuit of oscillator A. As the amplitude of the 800Hz squarewave signal varies in a cycle, the reverse voltage across the varicap diode varies accordingly, from a quiescent value set by VR1, thereby varying the diode's capacitance. For positive half cycles of the modulating signal, the varicap's capacitance decreases and for negative half cycles it increases. Since it is a part of the tank circuit of oscillator A, and as the frequency of oscillation of a 'LC' tuned circuit depends upon its 'C' value, the frequency of oscillator A varies in accordance with the amplitude of the modulating signal. The frequency modulated output can be had at the marked output terminals.

Potentiometer VR2 determines the maximum amplitude of the modulating signal to be coupled to the varicap diode. So, the maximum deviation of carrier frequency and hence the modulation index, which determines the amplitude of the 800Hz AF signal after demodulation in the coupled receiver, depends upon the setting of VR2.

Construction

The complete signal generator can be mounted on a single PCB. Special attention is required regarding wire dressing as unnecessary coupling may affect the frequency of oscillation of oscillator A, and hence the generator's performance.

Since frequencies of the two oscillators are independent of power supply variation, stabilised power supply is not required for them. However, due to the presence of the varicap diode, variation of supply voltage produces some unwanted frequency modulation. Due to the stated reason



1: Circuit diagram of the FM signal generator.

PARTS LIST

Semiconductors:	
IC1	NE555 timer
T1	BF194B RF transistor
D1	BB105 varicap diode
Resistors (all ¼ watt, ±5% carbon):	
R1	820-ohm
R2	330-ohm
R3, R6	1-kilohm
R4	47-kilohm
R5	3.3-kilohm
R7	15-kilohm
R8	- 220-kilohm
VR1	47-kilohm, vertical preset
VR2	- 220-kilohm, vertical preset
Capacitors:	
C1, C6	1kpF, ceramic disc
C2	0.005μF, ceramic disc
C3, C4	- 22pF, styroflex
C5	- 22pF, mini button trimmer
C7, C8	- 0.01μF, ceramic disc
C9	0.047μF, ceramic disc
C10	— 1000μF, 12V electrolytic
Miscellaneous:	
L1-L4	Oscillator coil (see text)
RFC	RF choke (see text)
S1	- 4-pole, 2-way switch
S2	- On/off switch
BATT.	- 9V PP3 battery
	— Battery holder, PCB, BNC socket, enclosure, flexible wire etc.

some amplitude modulation persists as well. Allowing a little variation, a battery of four cells in series with a terminal voltage ranging from 5 to 6 volts, may be used without affecting the operation of the generator greatly.

Inductances L2, L3 and L4 are three coils wound one over the other. Coil L2 is wound first, then L3 is wound over it and finally L4 is wound over L3. L1 is tapped from L2. The details of coil windings are given below:

Inductance	**No. of Turns**	**Wire**
L1	2	36SWG enamelled copper wire to be used for each coil
L2	42	
L3	20	
L4	4	

The outside diameter of the coil former is approximately 7.5 mm – a standard coil former available in the market – and no core is used. The RFC is an air core coil having 30 turns of 24 SWG enamelled copper wire. The diameter of the coil is 7.5 mm approximately.

Tuning procedure

Before using it as a service aid, the signal generator should first be tuned with the help of a good TV receiver. To do this, connect the generator output terminals to the inputs of the sound IC (viz, 3065, TBA750 etc), i.e. to the secondary of the sound IF transformer. Switch on both the TV and the signal generator.

Adjust VR1 to get a potential of the order of 0.3V at the junction of VR1 and 47k resistor. Position the arm of VR2 to the middle of its span. Adjust C3 to get an 800Hz audio tone (max.) from the speaker. Now by little adjustment of VR1, maximise this response.

If now VR2 is varied, it would only change the volume of the reproduced tone. The volume control of the receiver should be kept at normal listening position.

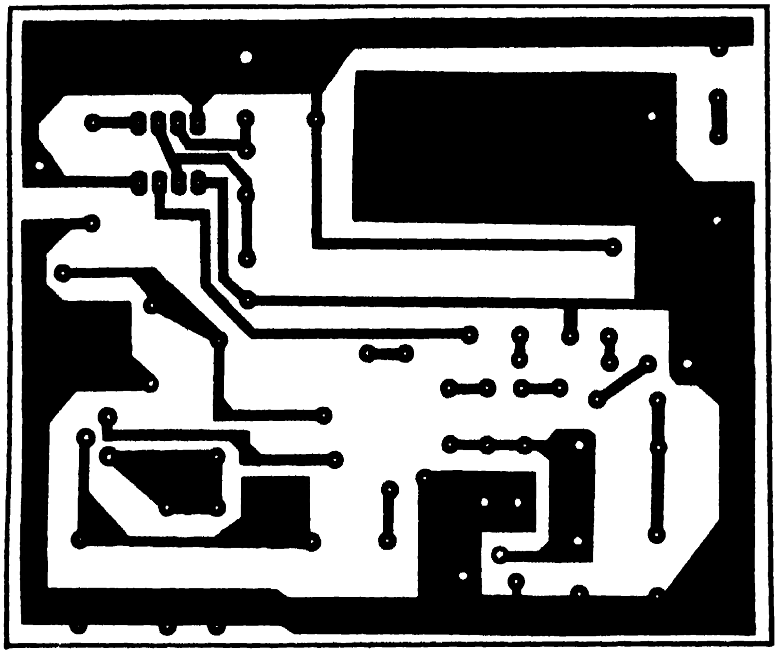


Fig. 2: The PCB layout of the FM signal generator.

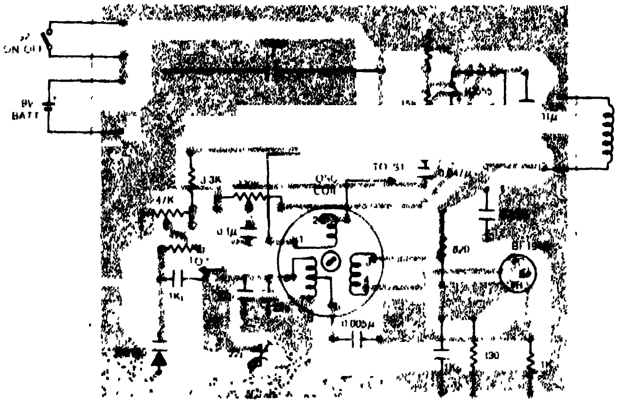


Fig. 3: Components layout for the above PCB.

APPLICATIONS

Alignment of the discriminator coil of a TV receiver

Connect the output of the generator to the input of the sound IC. Set the channel selector to a blank channel. Adjust the core of the discriminator coil for maximum undistorted audio tone.

If no sound signal can be traced, the IC is defective or stages after the IC are malfunctioning.

Checking the tuner and IF stages

Connect the generator to the antenna terminals of the TV under test. Set the channel selector to channel '4' and rotate the fine tuner. Though oscillator A is oscillating at 5.5 MHz, harmonics even of the order of 10, 11, 12 etc are also produced.

With channel selector at channel '4', a slight adjustment of fine tune control enables the receiver to tune two adjacent (12th and 13th) harmonics, simultaneously. These two harmonics, after being processed by different RF and IF stages of the receiver, produce a 5.5MHz (difference frequency between these two harmonics) FM signal at the input of the sound IC, and we get the 800Hz audio tone from the speaker as before.

If no sound is heard, then the tuner or IF stages are operating abnormally - provided all other stages concerned are functioning well.

Instead of connecting to the antenna terminals, the generator may be connected to the IF input for checking its operation separately. The orders of the harmonics in this case are 6th and 7th respectively.

Checking the video section

During checking the tuner and/or IF stages some inconsistent picture pattern appears on the screen, formed by a normally operating video section. If, on the other hand, no such pattern appears, but sound is there, it may be inferred that the video section is defective.

Of course, synchronising circuits cannot be tested with this instrument, for which a pattern generator is required.

AM receiver testing

The fact that the frequency modulation is accompanied with an amplitude modulation, can be used effectively for alignment of the front section of an AM shortwave receiver. To do this, place the generator 30 cm to 60 cm from a good shortwave radio receiver. Locate the harmonics on the dial and note their frequencies. You may get unaccounted harmonics produced by unwanted coupling. If so, you may increase the distance between the generator and the receiver to minimise such interference.

Now replace the good receiver with the receiver to be aligned. Select a shortwave band. Adjust the receiver's oscillator coil, antenna coil and corresponding trimmers to get all the harmonics present in the selected band at their proper position on the dial.

The same procedure can be applied to a FM receiver.

Testing the AF stages

Testing of AF stages beyond the detector of an AM or FM receiver can be done by throwing the RF/AF switch to AF position. Then output of oscillator B can be used as an 800Hz AF signal source, and the generator would then act as AF signal injector. □

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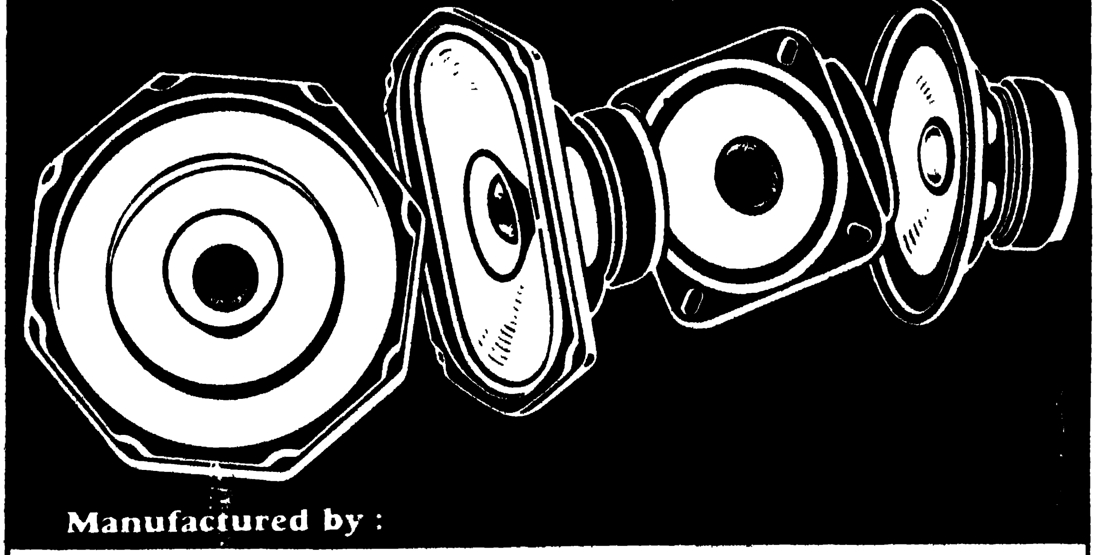

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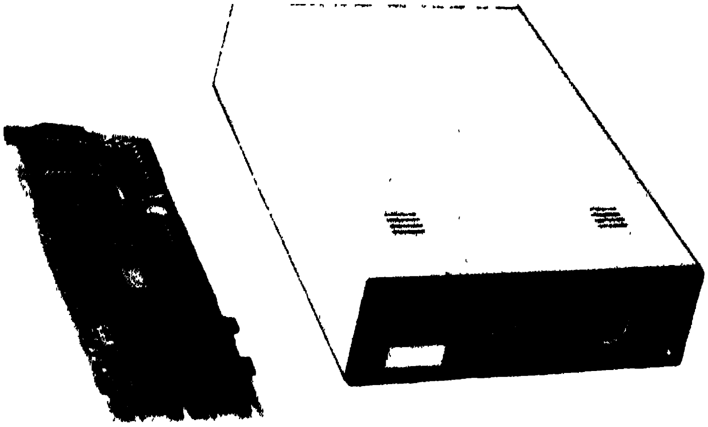

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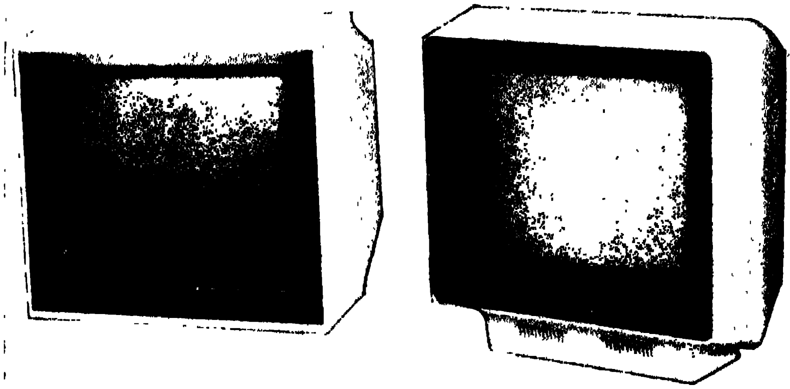

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TELEPHONE INDICATORS
Using LEDs

Here are a few interesting circuits to add to your telephone line. All these circuits have been designed and used by the author for over a year and have given a fully satisfying performance.

Fig. 1 shows an LED and a diode connected in reverse parallel along with a current limiting resistor. The combination is connected in series with the telephone instrument. A hole may be drilled on top of the main body of the telephone instrument, and an LED pushed in and glued with Araldite or any other suitable adhesive. The remaining two components may be soldered on the LED leads.

The value for R will depend on LED current rating. 220 ohms may be taken as nominal value, but other values may be tried to compromise between a safe current limit and brightness of the LED. Diode is essential for proper working of the circuit. It serves the dual purpose of protecting the LED when telephone line polarity changes (more about this while discussing Fig. 6) and at the same time of bypassing the conversation.

When the receiver is picked up, LED lights up, indicating that receiver is now off the hook. When a number is dialled, the LED blinks with the passing dial pulses. As soon as the called party picks up the receiver, LED extinguishes, indicating the call has matured. When the phone rings, LED flickers with the rhythm of the bell.

Fig. 2 shows a set-up similar to Fig. 1, except that the diode is replaced with another LED here. When the phone is picked up, red LED lights up. When the call has matured (called party picks up receiver), red LED extinguishes and green LED lights up. With ringing and dialling both the LEDs flicker. The LEDs may be of any other colour, but use of a single tri-state LED will give better results.

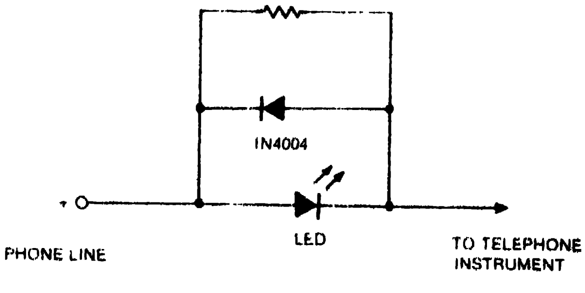


Fig. 1

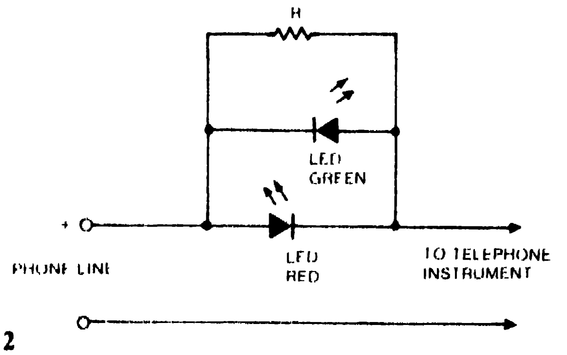


Fig. 2

Separate indicating units

So far the circuits were meant for adding one or two LEDs on the telephone instrument itself. The following circuits are designed to be separate units, connected across the telephone line.

An LED and a diode are shown connected reverse parallel in series with a capacitor in Fig. 3. Diode is essential to protect the LED. This circuit gives three indications, viz: (a) call is being dialled, (b) phone is ringing, and (c) conversation is in progress (this is indicated by feeble flashes in rhythm with the conversation).

If more than two phone instruments are connected to the phone line or two such units are to be connected to the same phone line, the capacitor should be 1μF, 160V non-polar type. However, if only one or two phone instruments are connected and only one such unit is required, the capacitor value may be increased to 2μF to give more brightness to LED.

The set-up shown in Fig. 4 is exactly similar to that in Fig. 3 and serves the same purpose. Only the diode is replaced here by another LED.

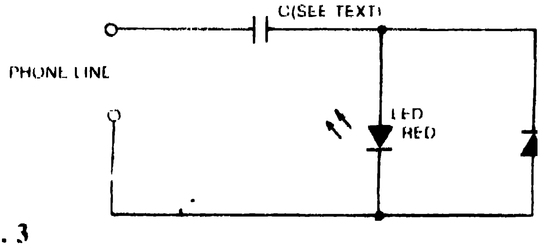


Fig. 3

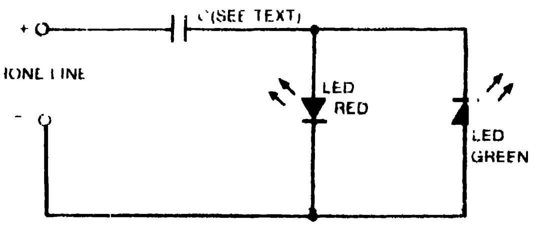


Fig. 4

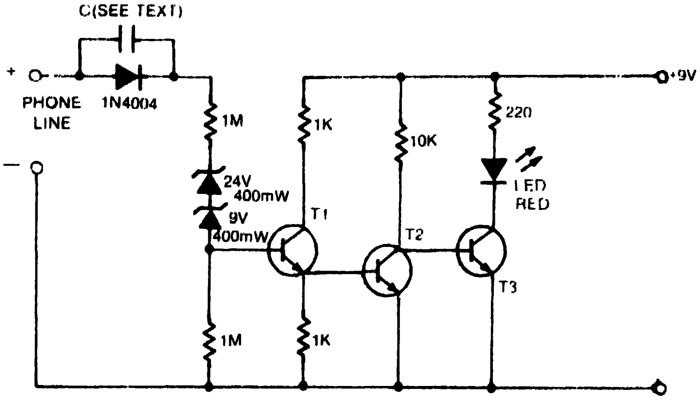
Indicators requiring power supply

So far the circuits utilised power delivered by the phone line itself. The following circuits require a power supply separately.

The circuit shown in Fig. 5 is based on the fact that telephone line voltage is about 50 volts DC but when its receiver is lifted it drops down to about 10 volts DC.

Diode in Fig. 5 passes only positive signals while the capacitor in parallel passes AC ripple which is required for producing bell effect in the LED. A 0.1μF, 160V non-polar capacitor was used in the prototype, but if more ringing effect is desired its value may be increased up to 0.22μF.

The circuit up to T2 is a voltage controlled switch while T3 acts as an inverter/LED driver. The two 1M resistors form a potential divider, while the zener diodes set control voltage for T1 and T2 to conduct.



T1-T3 ALL NPN TRANSISTOR OR BC 147

Fig. 5

Note that two zener diodes are essential for perfect operation of the unit. A single zener diode with even more than the combined value of both the zener diodes cannot stabilise the circuit operation.

Normally, both the zener diodes are conducting across potential dividers and the darlington pair T1-T2 is also conducting, while T3 is cut-off. As soon as phone is picked up the phone line voltage drops, zener diodes and T1-T2 become non-conducting and T3 conducts, switching on the LED. Thus, when receiver is lifted the LED lights up, and when the phone is dialled the LED blinks in step with dialling pulses, and similarly when the phone rings LED blinks in step with the incoming bell.

The advantage of this and the following circuits is that you get indication of all the phone instruments connected to the phone line.

The circuit in Fig. 6 utilises the fact that when the dialled party picks up the receiver, the phone line polarity changes, i.e. positive becomes negative and vice versa.

The circuit shown in Fig. 6 may be divided into two parts. The first part, up to T3, is a voltage controlled switch, similar to that shown in Fig. 5. In the second part, T4-T5 form a current controlled switch and T6 acts as an inverter/LED driver. When the receiver is lifted, T1-T2 become non-conducting and T3 conducts and lights up red LED.

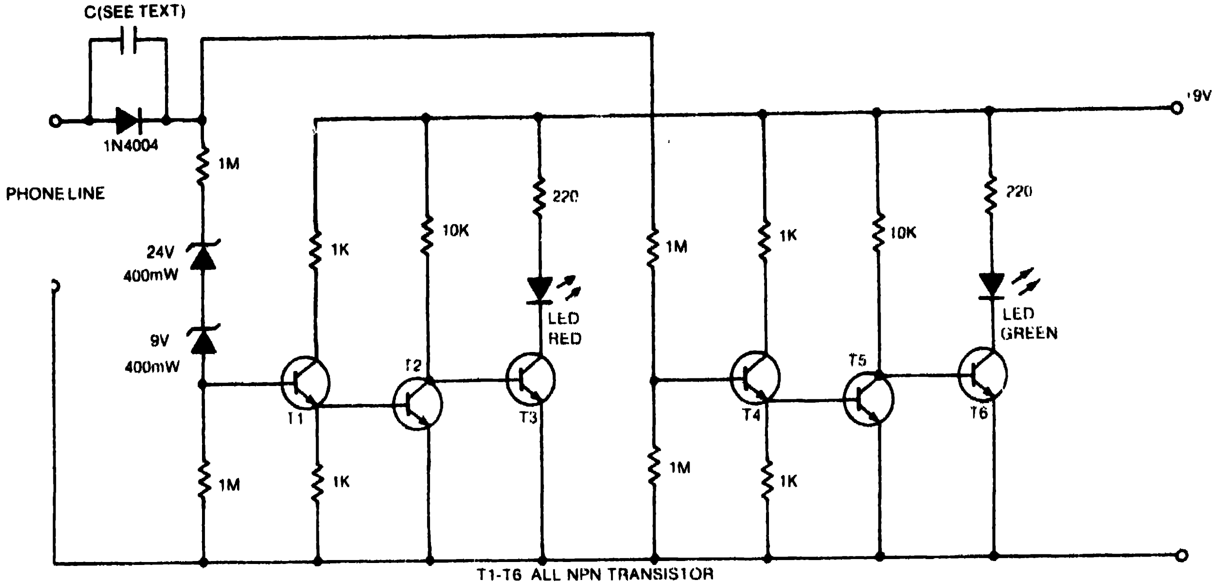


Fig. 6

But T4-T5 at this stage are conducting because here some current is still available; so T6 remains cut-off. After a number is dialled and the called party picks up the receiver, the phone line's polarity changes which makes diode 1N4004 non-conducting and T4-T5 are cut-off, and T6 switches green LED on, indicating that the call has matured.

The circuits in Figs 7 and 8 also indicate the state of the phone line is alright. The current limiting resistor for green LED is purposely chosen higher than that for red LED so that the green LED remains on most of the time and a higher resistor gives the LED a longer service life at the same time.

When phone line becomes dead, almost no current flows through the diode bridge, zener diode speeds up non-conducting state of T1, T2 and T4, and T3 starts conducting

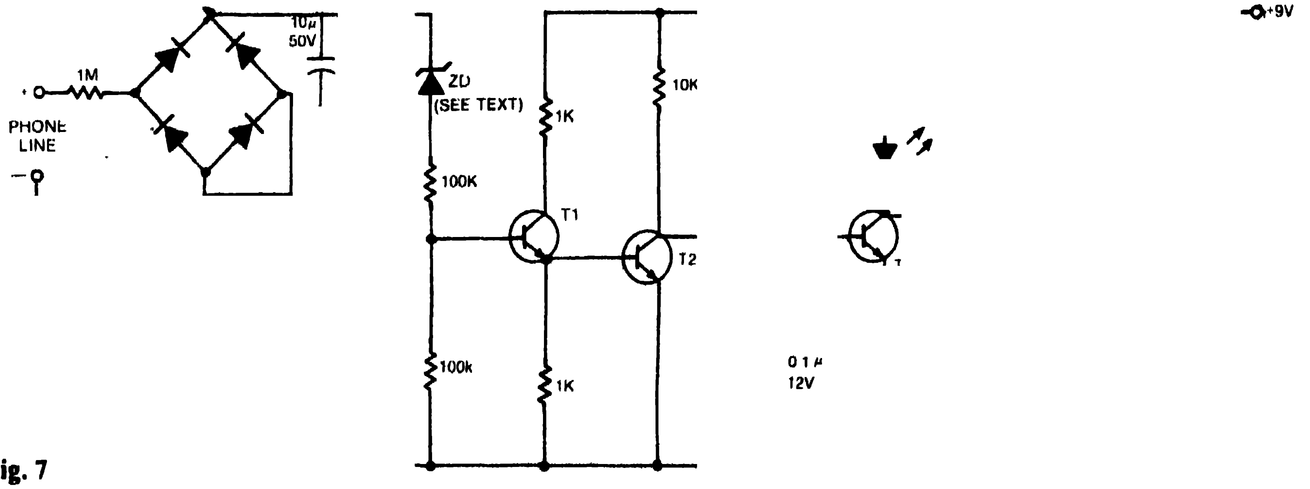


Fig. 7

telephone line. Here instead of a single diode, a bridge rectifier along with an electrolytic storage capacitor is used. Diode bridge maintains the output polarity, irrespective of input.

Zener diode sets the control voltage. The zener diode value may be 3 to 5 volts, depending upon the gain of T1 (although it may altogether be eliminated, but this will make the circuit very slow).

As long as current is available, T1, T2 and T4 in Fig. 7 conduct, the green LED is on and red LED is off, indicating that and red LED lights up while green LED extinguishes, indicating that the phone line is dead. If both the LEDs are off it means an electric power failure.

However, if a flashing LED or a beeper or both are required to indicate a dead phone line, power for a multivibrator or an oscillator or for both can be taken from emitter of medium power transistor SL100 (T3). A small heatsink may be added for T3. A relay can also be connected to switch on other circuits. No heatsink is necessary if only a relay is used.

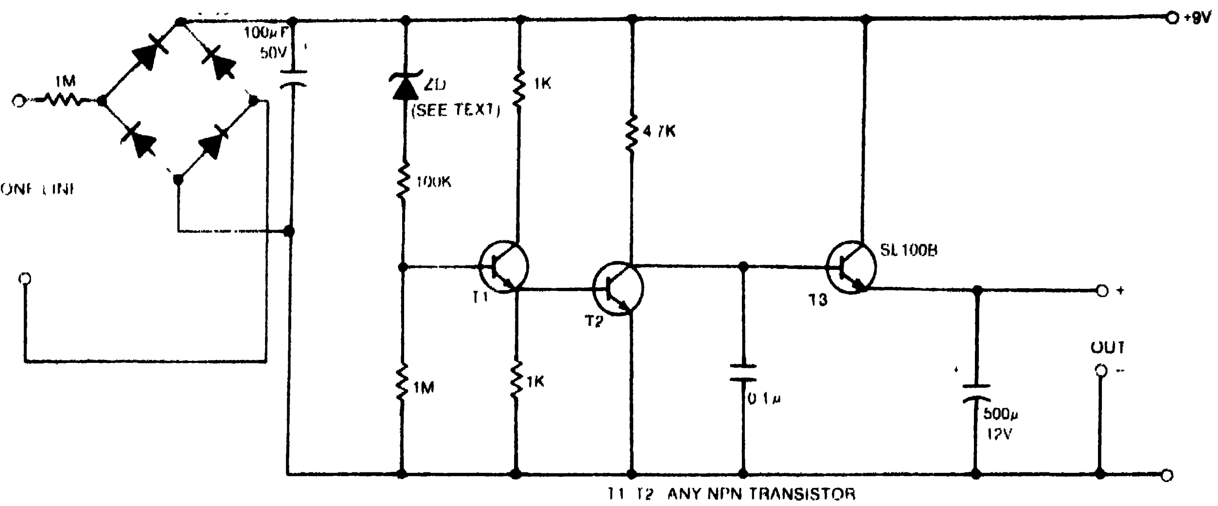


Fig. 8

Power supply and components requirements

Now a word for the power supplies and components required. No special power supply is needed. A standard diode bridge circuit (not full-wave) and a good filter capacitor 500μF, 16V (Philips or Keltron) is all that is required.

As the current drain of circuits shown in Figs 5 to 7 is small (about 75 mA), a small but good quality step-down transformer may be used. The author has used in his prototype 'Tivico' 200mA transformer, costing about Rs 6. For the circuit in Fig. 8, power requirement will be higher at the time of phone line failure. So a 350mA to 500mA transformer is recommended (costing Rs 8 to 10) for it.

All the transistors are BC147B (CIL or EC). For zener diodes EC will be a better choice. All the resistors are ¼ watt ±5% type.

Since all these circuits are meant to work day-in and day-out, year after year, use of the best quality components is suggested. ☐

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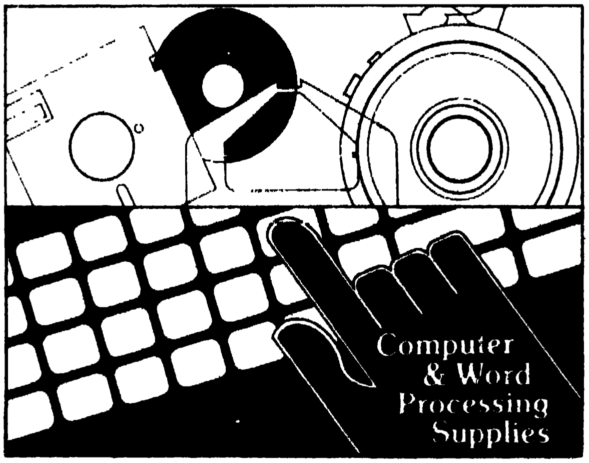

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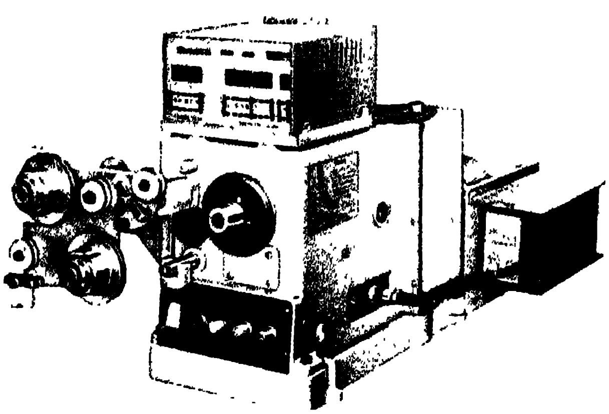

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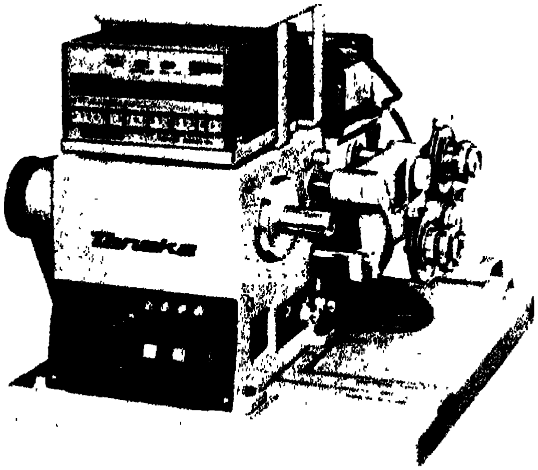

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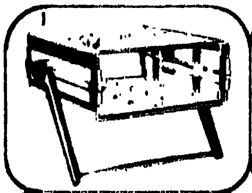
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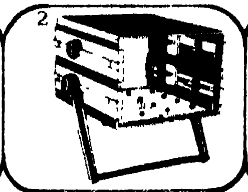
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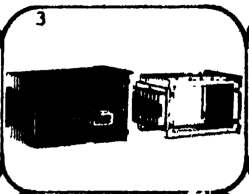
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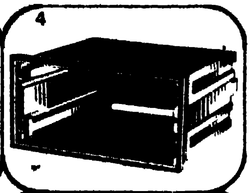
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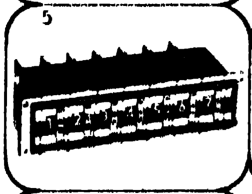
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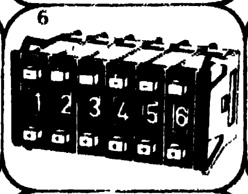

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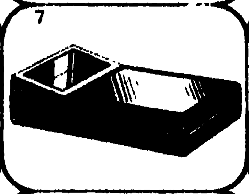
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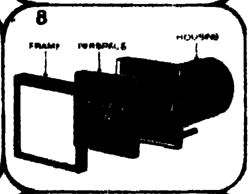

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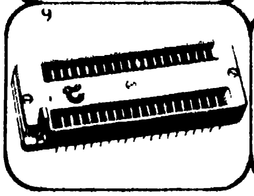
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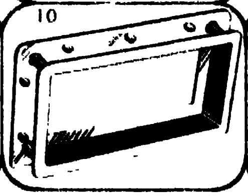
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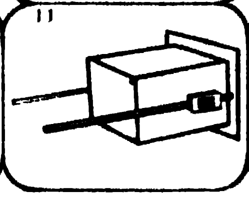
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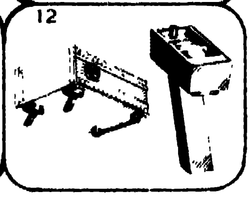

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Hourly Time Signal Add-on Circuit

The circuit gives a single beep or shrill sound every hour (at XX.00), so that one can recognise the time without seeing the clock.

Tables I and II give the information for the units of minutes and tens of minutes, which are present at the output of clock IC (at the inputs of 7-segment common anode displays). Of course, one can have Tables I and II for common cathode displays, just by changing 0's to 1's and 1's to 0's.

Tables for Common Anode Displays

TABLE I
Units of Minutes

Digit	Signal at 7-segment Display a	b	c	d	e	f	g
0	0	0	0	0	0	0	1
1	1	0	0	1	1	1	1
2	0	0	1	0	0	1	0
3	0	0	0	0	1	1	0
4	1	0	0	1	1	0	0
5	0	1	0	0	1	0	0
6	0	1	0	0	0	0	0
7	0	0	0	1	1	1	1
8	0	0	0	0	0	0	0
9	0	0	0	0	1	0	0

TABLE II
Tens of Minutes

Digit	Signal at 7-segment Display a	b	c	d	e	f	g
0	0	0	0	0	0	0	1
1	1	0	0	1	1	1	1
2	0	0	1	0	0	1	0
3	0	0	0	0	1	1	0
4	1	0	0	1	1	0	0
5	0	1	0	0	1	0	0

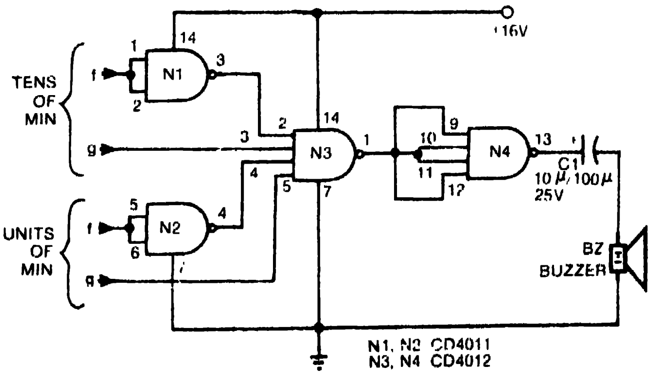


Fig. 1:

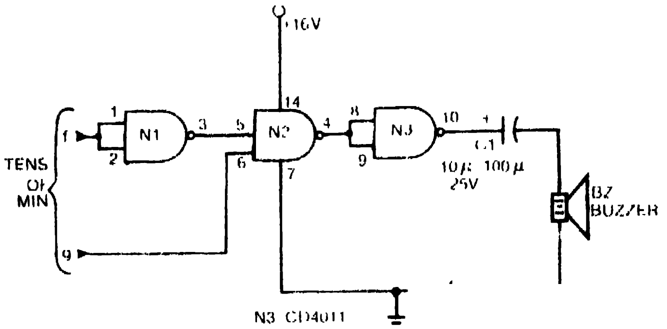


Fig. 2:

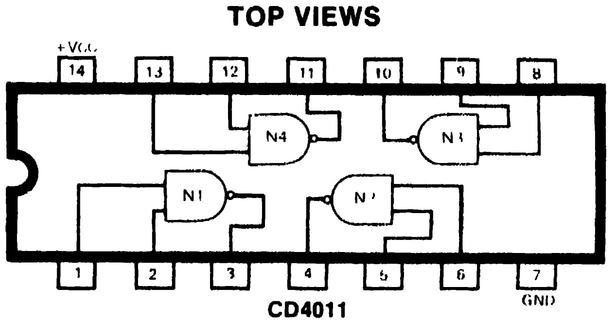


Fig. 3:

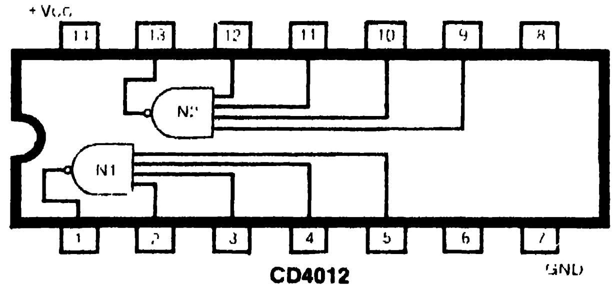


Fig. 4:

By keenly observing the Tables the '0' digit, the units of minutes signal at 'f' and 'g' is '0-1' and tens of minutes signal at 'f' and 'g' is also '0-1'. These logic signals appear in this combination only once in the Tables. So this information combination can be used to make the clock give short alarms every hour.

As shown in Fig. 1, when tens of minutes signal 'f-g' is '0-1' and units of minutes signal 'f-g' is also '0-1', then N3 output is '0' and N4 output is '1', that is just less than the supply voltage. For all other input combinations of N3, the N4 output is '0', that is '0' volts. Capacitor C1 helps the DC-buzzer to give short alarms instead of giving sound for full one minute.

'One can make use of only Table II to get the hourly time signal. But the buzzer gives small 'tick' sound for the display of XX.10, which is almost inaudible, as shown in Fig. 2.

As in Fig. 2, at every hour (XX.00), tens of minutes signal 'f' and 'g' is '0-1'. The signal 'f' is given to input of N1 and 'g' is given to input of N2. When 'f-g' is '0-1', the N1 output is '1' and N2 output is '0'. The signal is inverted by N3 to get '1'. The DC-buzzer gives short-alarm sound with the help of capacitor C1.

D LINGA REDDY

Office Bell With In/Out Indicator

This circuit uses three 7-segment, common anode displays instead of two LEDs for the in out indicator as is done generally. When the calling bell pushbutton is pressed this indicator shows alphabetically 'In' or 'Out', as it is directed manually.

When you are in your office room, keep the rotary switch in 'A' position. Whenever your visitor comes and presses the bell he gets a surprise to see the word 'In' glowing brightly on the wall. When you are out, keep the rotary switch in 'B' position in order to indicate to your visitors that you are not inside.

Now let us discuss the circuit. When the pushbutton is pressed, the IC1 (555) produces an audible tone and at the same time this 'high command' made by the pushbutton is inverted by a NOR gate (N4) to trigger the monostable IC2 (555). The pulse duration of this monostable is determined by 1.1 × RC and the pulse triggers the relay which in turn activates the displays.

Any segment in the displays will glow only when it is fed with a logic low pulse. Table I shows the logic levels of all the segments for each of the two cases. Also, some of the segments should remain always at logic high state and some at logic low for both the cases. The 'always high' state is achieved by directly feeding with the positive supply rail and this is inverted by a NOR gate (N3) to get the 'always low' state.

When the word 'In' is to be displayed, X and Y should be at low and high state respectively. So then at least one of the inputs of the NOR gate (N1) should be high. Similarly, for 'Out' to be displayed, both of the inputs should be low.

The display remains on as long as the monostable gives a high output. After the precise time-duration, the relay gets de-energised and the display goes off.

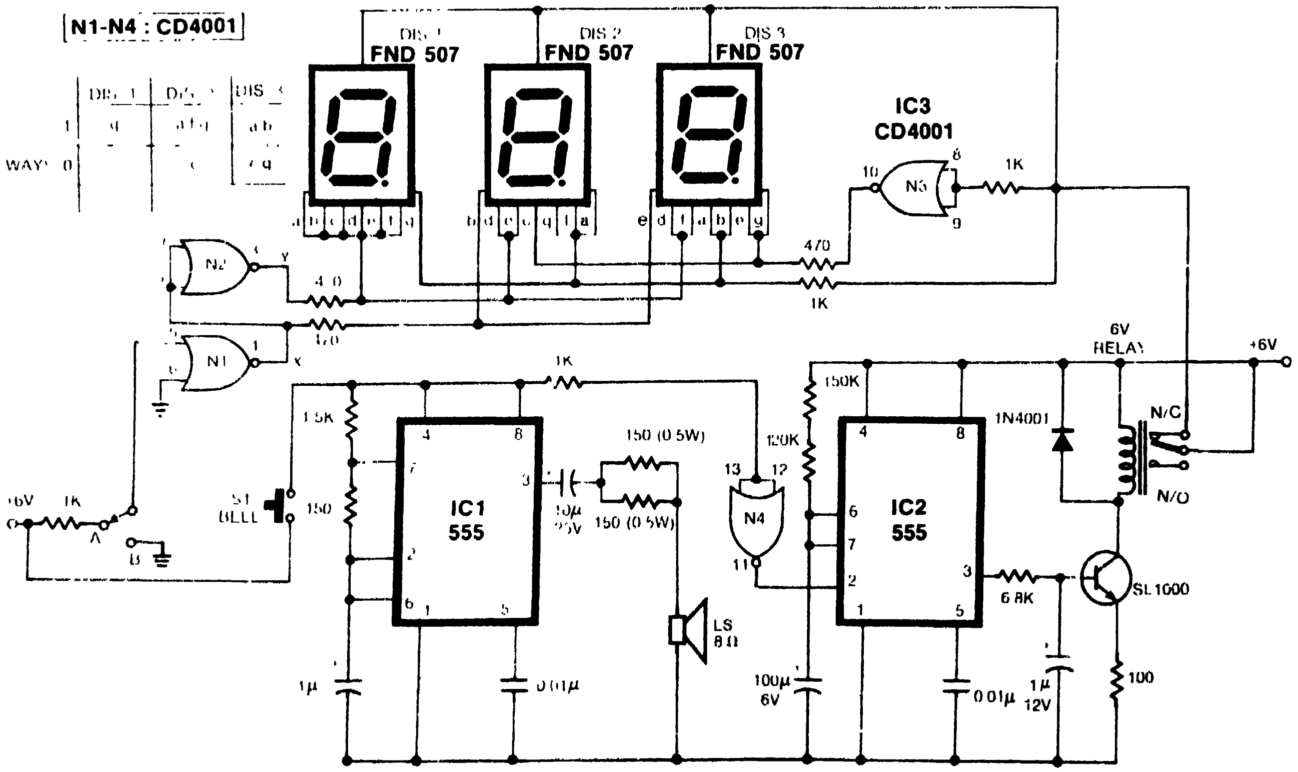


TABLE I

	a	b	c	d	e	f	g	LETTER
Dis 1	0	0	0	0	0	0	1	O
Dis 2	1	1	0	0	0	1	1	u
Dis 3	1	1	1	0	0	0	0	t
Dis 1	1	1	1	1	1	1	1	
Dis. 2	1	0	0	1	1	1	1	• !
Dis 3	1	1	0	1	0	1	0	n

Care should be taken to provide a separate power supply bus for the multivibrators such that the relay action does not hamper this. Any power supply with 6V, 100mA output rating can be used with this circuit.

AMIT BASU

Remote Optical Switch

It is sometimes very annoying for a person who, while watching a TV programme or listening to a radio or the like, has to get up to switch the set off. The same applies when he wants to switch it on. Using the simple circuit shown in Fig. 1, one can switch almost any domestic electrical equipment from a distance, simply by flashing a torchlight.

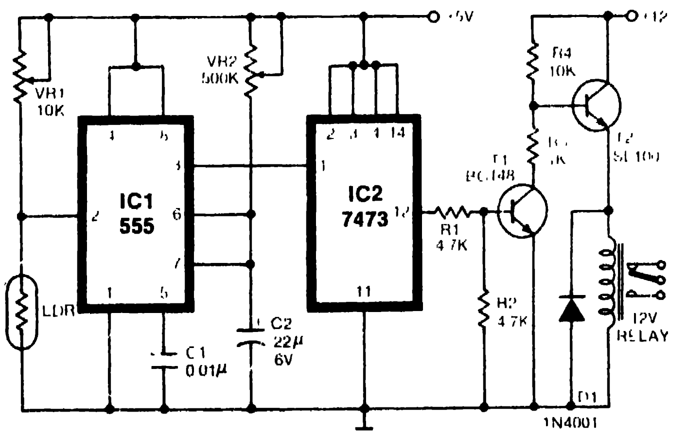


Fig. 1: Using TTL ICs.

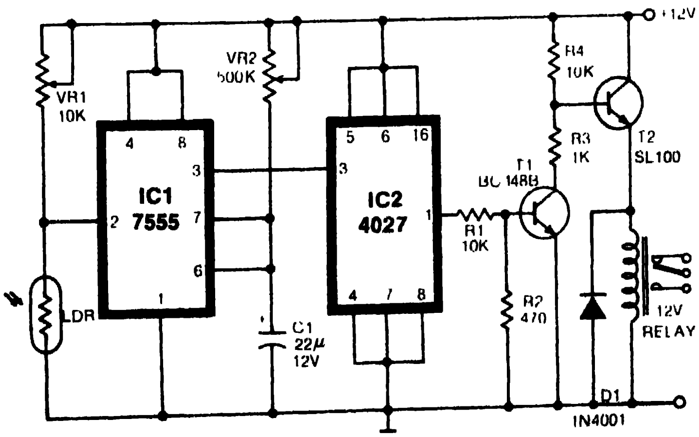


Fig. 2: Using CMOS ICs.

The basic sensor used in this remote switching mechanism is a light dependent resistor (LDR), whose resistance value changes in response to the incident light. The 555 timer is used in the monostable mode in Fig. 1, which is triggered when the voltage at its pin 2 falls below 1/3 Vcc. This triggering takes place when light is incident on the LDR, thus lowering its resistance value. The 10k pot VR1 is used for setting up the triggering threshold. The output time period of the 555 is adjustable up to 12 seconds by varying the 500k pot VR2, so as to smooth up the light impulse (similar to switch debouncing).

The output of the 555 is fed to the input of a J-K master/slave flip-flop (7473) which is configured in the toggle mode (by tying the J and K inputs to Vcc). In the toggle mode, the output of the flip-flop changes state with every pulse at its clock input.

The output of the 7473 feeds an amplifier stage comprising a BC148 and a SL100 transistor which are used to drive a relay that switches the instrument to be controlled.

The circuit can be mounted on a small veroboard and placed in a cabinet with a small hole for exposing the LDR. Care should be taken to ensure that the LDR receives only the light from the torch, and that no ambient light falls on it. Once so installed, it will work reliably, with no false triggering that sometimes occurs in sound-operated remote control units.

This circuit has an appreciable, though small, current drain so that it should be switched off when not in use. However, by using the CMOS timer 7555 instead of 555 and the CMOS J-K master/slave flip-flop CD4027 instead of 7473, this becomes unnecessary as the current drain is negligibly small. This modified circuit has the added advantage that it requires a single +12V power supply, and the supply voltage need not be tightly regulated (CMOS devices work within supply voltage limits of +3V and +18V). The modified circuit is shown in Fig. 2.

INDRANIL SEN GUPTA

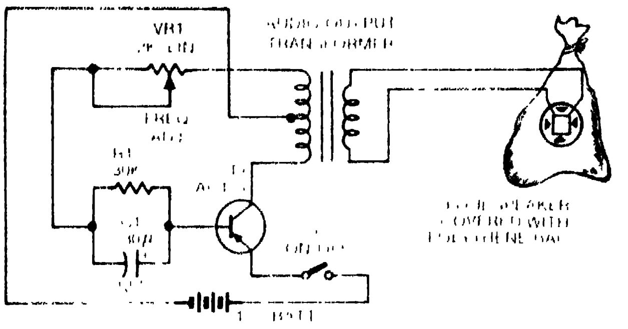
Electronic Fish Caller

This project follows Mr Sunaabh Sarkar's letter in Jan. 1985 issue of EFY. This project for electronic fish caller can be prepared with ease.

The parts needed for the project are:

One transistor (AC 125);
One 30µF, 12V capacitor (electrolytic),
One 30k, ¼W resistor;
One 2k potentiometer;
One output transformer (push-pull, primary impedance 500 ohms and secondary 8 ohms);
One loudspeaker (same as used in transistor sets); and three 1.5-volt cells

The device is an audio oscillator capable of producing different notes similar to the sound made by insects. Its output frequency can be varied by means of a potentiometer.



The loudspeaker can be housed in a cardboard box (not too large). The speaker unit should be heavy enough so that it can sink easily in water. It should be covered with a watertight polythene bag to prevent water from getting inside.

After assembling the apparatus, immerse the loudspeaker unit in a pond or in a lake with clear water and lots of fish. It will be found that fishes get slowly attracted towards it. Of course, the tone which may attract a certain variety of fish may repel another. By means of the potentiometer the tone can be varied and different varieties of fishes can be attracted or repelled.

FARAJ JAN QAISAR

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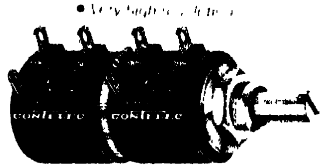

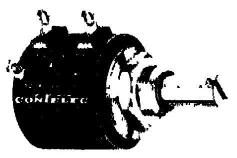

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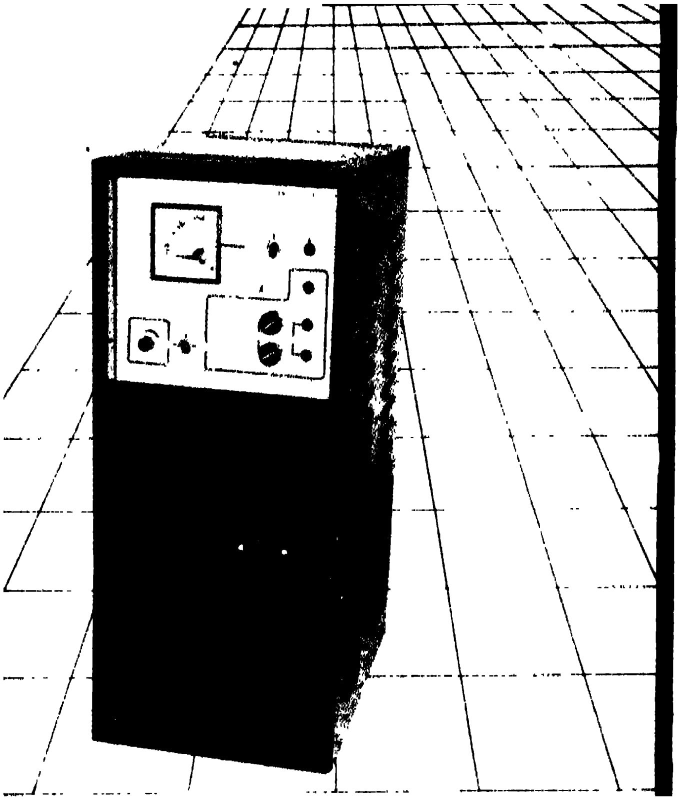

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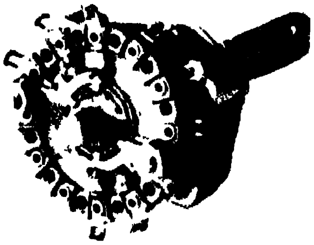

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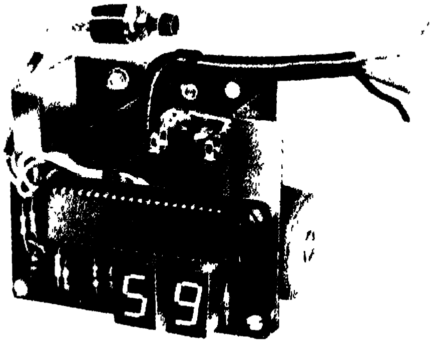
Product Profiles

DIGITAL COUNTDOWN TIMER

The Digital Countdown Timer from Ion Electricals CDT59 is ideal for any electrical appliance which is required to be switched off automaticall,', after a certain amount of time Typical examples are. cooking/baking ovens, water heaters, centrifuges and laboratory equipments etc It can also be used as an elapsed time reminder by virtue of its built-in buzzer



DIGITAL COUNTDOWN TIMER

CDT59 consists of transformer, printed circuit board (PCB), relay and piezo-electric buzzer - all mounted on a passivated metal sheet chassis The PCB is degreased, ultrasonically cleaned and laquered for protection from moisture Instrument grade transformer, reliable relay and solidstate buzzer are used The relay rating is 6 amps (resistive) at 240V AC 10-amp relay can be provided on request

Contact Ion Electricals, 307 Owner's Industrial Premises, 505 Gabrial Road, Mahim Bombay 400016

STATIC CONTROL WRIST STRAP

Marvel Products has introduced Wrist Strap with ground cord which can instantly dissipate static charge on the person wearing it

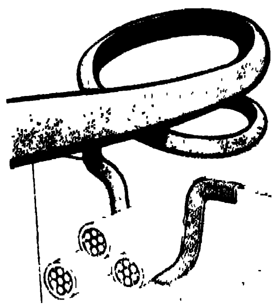
The strap is 25cm long and adjustable The ground cord is soft insulated wire with two 0.5-megohm metal resistors in series This device is an effective protection against potential damage to static sensitive components and microcomputers

Contact Marvel Products, 208 Allied Industrial Estate, Mahim, Bombay 400016

STATIC CONTROL WRIST STRAP

EDGING STRIPS

Novoflex offer Novorim Edging Strips, ideal edging material for metal, wood, glass and certain plastics, which can be easily applied to external or internal radii as well as straight edges The strip permits a clean and rapid installation



EDGING STRIPS

Current uses are for covering potentially dangerous sharp edges, as found on bulk head cutouts, instrumentation enclosures, control panels etc Novorim makes the panels vibration and shock absorbing and protects from moisture and dust These edging strips are resistant to oil, acid, alkalies and are non-conductive and non-corrosive

Contact Novoflex Cable Industries, 7th Floor, Chatterjee International Centre, 33A Chowringhee Road, Calcutta 700071.

SINGLE PHASING PREVENTERS

NCS Electronics offers Single Phasing Preventers types MSP, MLS and MGP with LED displays for various motor protections

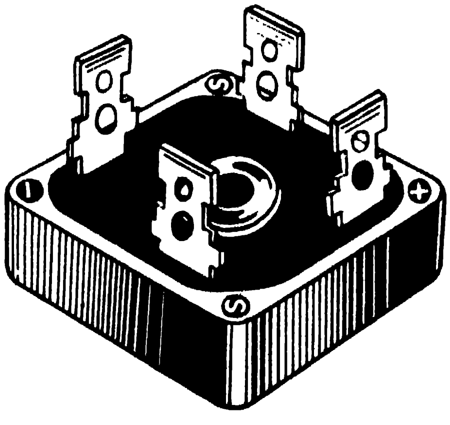
Type MSP protects the motor from single phasing, input supply unbalance and reverse running. The unit consists of a voltage sensing filter, power supply and control circuitry Type MLS has motor protections for reverse running, unbalance, over and under voltage along with single phasing.

Type MPG is a combination of type MSP and water level guard. It has an additional dry run protection essential for submersible motors. This unit continuously monitors the water level through conductivity of water and trips the starter if the motor runs dry

Contact NCS Electronics. Uma, 12 Mitramandal Colony, Parvati, Pune 411009

MODULAR RECTIFIER BRIDGES

Apollo Electronics offers SSE brand, hermatically sealed Modular Rectifier Bridges with wide temperature range (-40 to 170°C) available in 5, 10, 25 and 35 amps capacity in electrically isolated metal case (isolation voltage 2000 Volts)



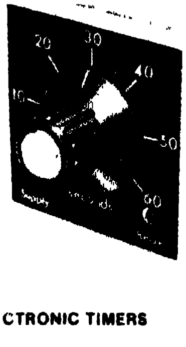
MODULAR RECTIFIER BRIDGES

Various types of silicon rectifiers of 6 amps to 400 amps up to 1600V and fast recovery rectifiers of 1 amp to 250 amps up to 1200V in both standard and reverse polarity, thyristors and triacs of 1 6 amps to 2000 amps RMS up to 1400V and a wide range of switching power transistors and power darlingtons are also available. Relays, connectors, ICs, displays, microprocessors and supporting devices and all other electronic components are also offered

Contact Apollo Electronics, C-1 Hari Preet, 42 St Andrew's Road, Santacruz (West), Bombay 400054

ELECTRONIC TIMERS

Koenig type K-series Electronic Timers



ELECTRONIC TIMERS

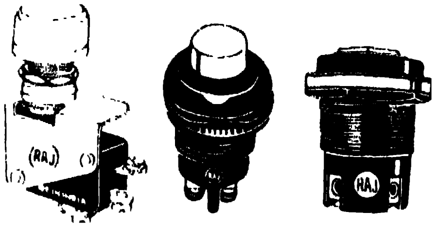
incorporating the latest CMOS technology are available in two different operating modes namely, 'delay on energise and 'interval on

More than 4000 different combinations of operating modes, contact configurations input voltage, and control location are available Each unit is enclosed within a compact plug in module having 8-pin 11-pin or screw terminal base which provides two sets of changeover contacts rated for 10A 250V AC, resistive load

Contact Konnig Electronics & Industries (P) Ltd 54 Industrial Area Phase II, Chandigarh 160002

PUSHBUTTONS

Raj Micro Pushbuttons and incher pushbuttons match international standards and are available with one normally open and one normally closed contacts



PUSHBUTTONS

These are rated for 2 amps, 5 amps and 10 amps ratings. The micro pushbuttons are used in instruments and panels while the incher switch is ideally used in domestic mixers and grinders Pushbuttons are used in control panels and starters

Contact Raj Industries, 118 Gurunanak Udyog Bhavan L B S Marg, Bhandup, Bombay 400078

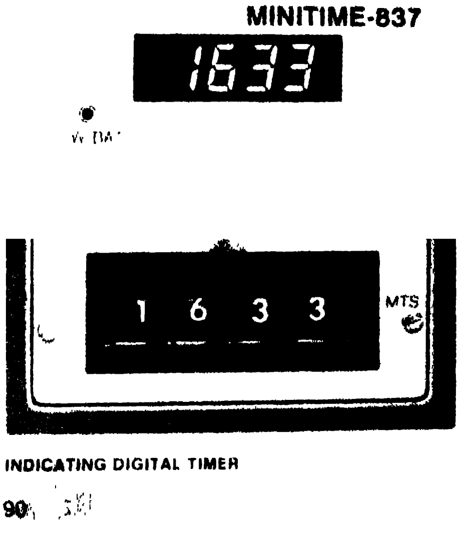
INDICATING DIGITAL TIMER

IRA offers Indicating Digital Timers, with relay output to energise at the end of set time period, find application in process control where time programming is required Time programming is made on a set of 2/3/4 thumbwheel switches

When the equipment is switched on, the display will show the value set on the thumbwheel switches and at the rate of least count it starts counting down as time elapses. At zero time as seen on the display, an internal relay energises and the contacts changeover.

Optionally, a memory and battery back-up could be provided for mains failure intervals Automatic low battery annunciator is built-in After resumption of mains, timer starts from the point where it had stopped and display would come on A relay output having one changeover contact rated for 230V, 50Hz, 5A resistive load is provided. A red LED lamp indicates relay energised condition

Contact. Instrument Research Associates Pvt Ltd, P B. No 2304, 79/1-2 Magadi Road, Bangalore 560023.

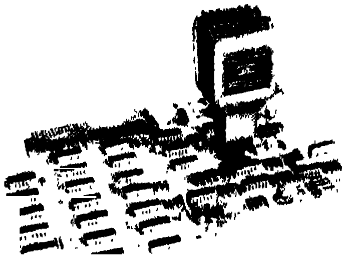


INDICATING DIGITAL TIMER

LOGIC CLIPS

Alfa Logic Clip LCU-16 is an extremely handy design and troubleshooting instrument which clips onto DIP integerated circuits up to 16 pins and instantly displays the logic states of all the 14 or 16 pins of the IC under test Each of the 16 channels of the clip independently follow the level changes at the corresponding pins and the LEDs light up brightly on the pins showing logic high

The clip has its own gating logic for locating ground and positive power supply from the circuit under test and no external power supply is required The built-in buffered inputs reduce circuit-loading. These Logic Clips are compatible with almost all the logic families like TTL, S, LS, MOS and CMOS etc and the adjustment of threshold voltage is automatic, making these clips truly universal.



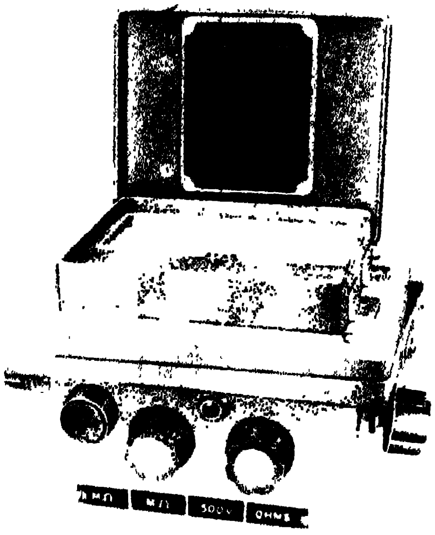
LOGIC CLIPS

Contact. Alfa Products Company, FF-11 Bajaj House, 97 Nehru Place, New Delhi 110019.

INSULATION TESTER

EEC has developed an intrinsically safe Insulation Tester which can be housed in hazardous areas where danger of igniting combustible gases is always present The unit can also measure low resistances up to 100 ohms and voltages up to 25V AC/DC.

The instrument is housed in unbreakable fibreglass enclosure and powered by rechargeable Ni-Cd batteries It finds extensive uses in chemical, petrochemical plants, oil and gas installations, mines, ammunition dumps etc.



INSULATION TESTER

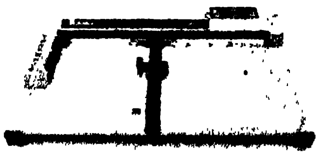
Contact Electrical Equipment Corporation, 13/63 Punjabi Bagh, New Delhi 110026

DIGITAL GRAPHICS PLOTTERS

Anika Instruments offers India's first and only multicoloured Digital Graphics Plotters Compatible with almost all micro, mini and mainframe computers, these microprocessor controlled plotters can be used to plot, on paper or film, high precision graphics generated by the computer systems.

The 2600 is an 8-pen, highly intelligent graphics plotter which can plot on any size paper or film including DIN A3 and A4. It has high writing speeds of 45 cm/sec in all directions giving stable line quality at all times. The plotting resolution is of the order of 0.05mm per step which allows high precision, camera-ready graphics This high resolution also allows it to be used to produce overhead projector slides

The plotter has a built-in comprehensive ASCII character set as well as other intelligence like various types of lines, arcs, circles etc It has a standard 3k RAM buffer memory, expandable to 10k The plotter, under the computer control can slant or rotate characters and can also be used in the printed mode. The 2600 is compatible with almost all computers with three types of interfaces, i e RS232C, IEEE 488 and the centronics parallel. It is also directly compatible with IBM PC, Apple and other micros.



DIGITAL GRAPHICS PLOTTERS

Contact: Anika Instruments (P) Ltd, 24 Housing Society, N.D.S.E. (I), New Delhi 110049.

WOODEN LAMINATED CABINETS

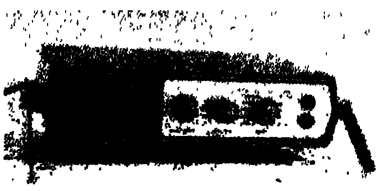
Electrocrafts (India) offers high quality Wooden Laminated Cabinets of 51cm, 35.5cm and 30.5cm sizes for black-and-white and colour TV sets.

Ten different models of cabinets are available. New models can be developed as per design and requirements.

Contact: Electrocraft (India), 459-B/5 Mahavir Block, Bhola Nath Nagar, Shahdara, Delhi 110032.

DIGITAL CONDUCTIVITY METER

Century Instruments offers its latest model of Digital Conductivity Meter which incorporates cell constant compensation from 0 01 to 1.99.



DIGITAL CONDUCTIVITY METER

This cell constant is adjusted with the help of a potentiometer by displaying it on digital display This facilitates the conductivity measurements of solutions having low conductance values The range covered is from 0 to 1000 megohm and is divided into five ranges to get better resolution and accuracy.

Besides conductivity, resistivity also can be measured using the instrument. Automatic temperature compensation is also provided on demand for direct reading of conductance.

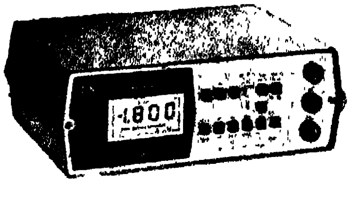
Contact: Century Instruments Pvt Ltd, S.C O. 289, Sector 35-D, Chandigarh 160036.

DIGITAL MULTIMETER

R.S. Digitronix introduces its new 3½-digit, true RMS Digital Multimeter with both digital and analogue display.

This combination of digital and analogue LOD display analyses both steady and pulsating signals, plus differential plus and minus peak holding capability and fast pulse detection and indication. True RMS measurements for non-sinusoidal signals are also available.

Its other features include 50μ/sec pulse detection and visual/audible indication of continuity and logic levels.



DIGITAL MULTIMETER

Contact: R.S. Digitronix Pvt Ltd, International House, L.B.S. Marg, Vikhroli, Bombay 400083.

GRAPHIC TERMINAL

O/E/N Micro Systems' model CT 4000 monochrome Graphic Terminal offers a low cost alternative to computer graphics applications in engineering design, process control and business graphics It offers a 512 × 256 pixel resolution on a 30.5cm CRT with green phosphor.

Designed around a Z-80 CPU and 7220 graphic controller, CT-4000 offers a 16k RAM for user program development and 16k ROM which includes a powerful BASIC interpreter with graphic commands capable of developing graphic software Graphic premitives available include full cursor control, continuous trace mode, 256 line types, 16 different character sizes, video attributes like reverse video, underline, special graphic symbols, area fill, generation of rectangle, circle etc. These premitives can be accessed by the host computer also in the remote mode.

Keyboard has full ASCII alphanumeric and graphic function keys. RS-232C serial interface is available for host communication Floppy disc back-up storage and printer ports are offered as options

Contact: O/E/N Micro Systems Ltd, P.B. No. 2, Vyttila, Cochin 682019.

POWER TRANSISTORS

SSE has a complete line of Bipolar Power Transistors and Power Darlingtons with proelectron numbers covering 30 to 1000 volts in 1 to 100 ampere ratings The series covered are: BDW, BDX, BUR, BDY, BUT, BUV, BUW, BUX. These are in addition to the older JEDEC series which cover up to the 2N66XX series.

POWER TRANSISTERS

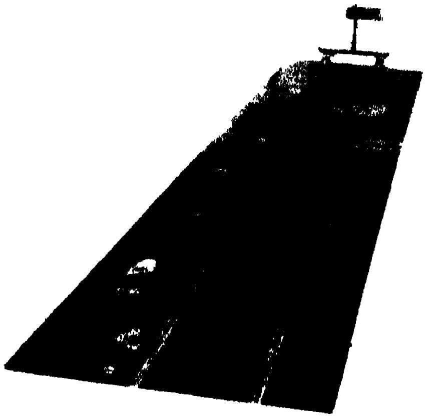
The Power Darlingtons are fully integrated devices with biasing resistors, speed-up diodes and flyback diodes for extremely fast switching. These prime devices are made in the high reliability metal package outline. TO-39, TO-66, TO-3. Depending on the ratings, the device outlines are modified for high isolation voltage or high current.

These transistors are matched by a series of power schotty and power epitaxial diodes with low, forward plus reverse recovery time. They cover 25 to 400 volts in 3 to 70 amp ratings. SSE also makes MJ 8500 to MJ 8505 series Power Transistors with voltage up to 800 volts in 2-5 amps to 10-amp rating and BU536 series, BU205 series and BU208 series.

Contact. Solid State Electronics Co. Pvt Ltd, Plot No 9/123, Marol Co-operative Ind. Estate, P O Box No 7432, J.B. Nagar Post, Bombay 400059.

DUST COLLECTION MATS

Spirig of Switzerland manufacture Plast-Tera-Syn (PTS) Mats to protect clean rooms from traffic-borne contamination. The mats can pull dust, dirt and even bacteria from shoe soles and trolley wheels



DUST COLLECTION MATS

Made of a plastic tacky material, the mats can be spread from wall to wall before entrances of contamination sensitive areas. No adhesive material is required for flooring The mats are fully washable and reusable. They have high durability and wear resistance.

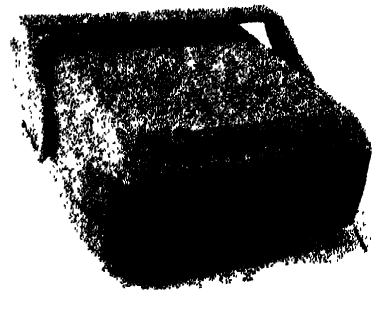
PTS is also available as stop-slip pads of extremely high friction coefficient for covering assembly benches and laboratory tables.

Contact: Jainsons Engineering and Electronics Corporation, 175 Samuel Street, Post Box No 5245, Bombay 400009.

STATIC NEUTRALISER

The X-Static unit from Westward Electronics, USA is a Static Neutraliser composed of positive and negative voltage generators with each generator producing approximately 5000V. These voltage sources, connected to the needles, create both positive and negative ions in the air surrounding the needles

In use, the ionised air is attracted toward



STATIC NEUTRALISER

any grounded or charged objects Charged material will be discharged by the appropriate ion. For maximum efficiency, the unit should be placed 10cm to 61cm above the work at hand so that ions will flow in a natural path toward ground The unit does not have to be hung vertically

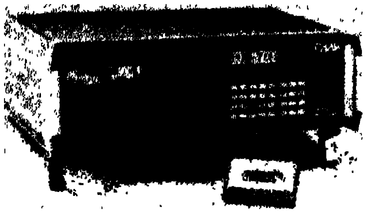
Although there is no electrical hazard involved in touching a needle (a 30-megohm current limiting resistor is in series with each voltage source), the body will charge to a 5000V potential when a needle is touched If a grounded object is touched, the event will be the same as if a person had walked on a carpet and gotten a shock

Contact Electronics Continental, Post Bag No 330, Bangalore 560003

CASSETTE TERMINALS

Cristie, UK offers digital tape Cassette Terminals for OEMs and enducers, widely used in process control and data logging applications.

Automatic or external software controlled cassette terminals provide up to 1.6MB storage capacity with RS-232C, IEEE 488, 20mA current loop interface ports. These Cassette Terminals are also used in data interchange, program loading, NC controllers, cash registers, off-line data preparation from tachograph chart analysers, fuel flow metering systems, hand-held data entry terminals and point of sale terminals etc.



CASSETTE TERMINALS

Contact. Southern Dynamics Pvt Ltd, P.O. Box No 1274. Madras 600034.

PORTABLE FFT ANALYSER

CF-300 introduced by Ono Sokki Ltd, Japan is the world's smallest Portable multifunction high accuracy Analyser with a large built-in CRT display. It is a low cost instrument offering extreme ease of operation.

CF-300 offers wide dynamic range (70dB) up to 20kHz. A unique feature is 3-dimensional spectrum display and histograms of both phase and amplitude. Mass memory allows 32k words of signal data to be stored.

A digital zoom facility, third octave analysis capability, GPIB interface, and X-Y plotter drive capability are some other important features. CF-300 is the cost effective solution to many analysis problems, making full use of [illegible]vanced digital analysis capabilities.

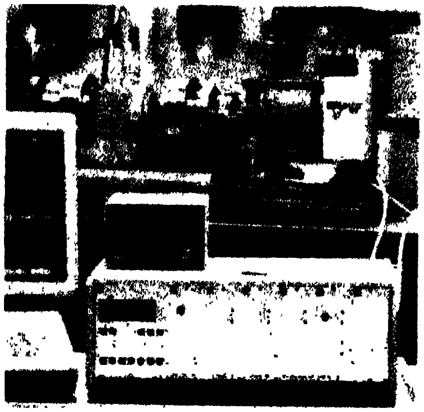
Contact: Aimil Sales And Agencies Pvt Ltd, Malhotra House, 2nd Floor, Opp. G.P.O. Bombay 400001.

COMPUTER CONTROLLED MEASURING SYSTEM

The new Computer Controlled Measuring System CM 3000 from Hottinger Baldwin, W. Germany now includes converter units for torque and speed, temperature measuring amplifiers, as well as amplifiers for mechanical quantities

The components of the system can be used to construct test-rig measuring equipment for detecting and processing measured values for torque, speed, power, pressure, force and temperature etc for either universal applications or for special duties The instruments are fitted with RS-232C and IEEE 488 interfaces as part of their standard equipment.

A fundamental advantage of the system lies in its dual function. It can contact a computer by two-way data transfer via the interface, while it can also operate as an independent measuring system when used without a computer, controlling its own functions by means of the built-in microcomputer



COMPUTER CONTROLLED MEASURING SYSTEM

Contact· Integrated Process Systems, 278, III Floor, Khaleel Shirazi Estates, Pantheon Road, Madras 600008.

LIFT TABLE FOR MOVING COMPUTERS

Trepel, UK has designed a special mobile Lift Table for Moving Computers and electronic equipment

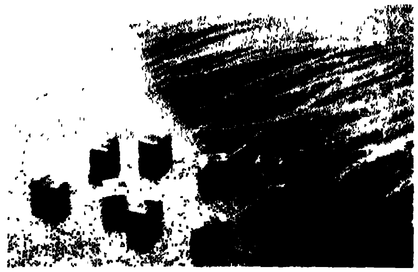
This mobile unit can move equipment weighing up to 1 tonne and get it safely into position The machine is made up of two parts, and linked with quick-release connectors The separate parts, the platform and scissor mechanism, and the base frame and power pack, can each be lifted and carried into position for assembly.

Contact: Trepel Ltd, New Road, Sheerness, Kent ME12, 1NB, England.

MINIATURE PTC THERMISTORS

The Miniature PTC Thermistors of the A707 to A709 series from Siemens are intended to be used as self-healing safety devices When the rated current is exceeded (100 to 200mA depending on the type), the PTC thermistor reaches its operating temperature as it heats up and takes on a high impedance value. Once the short circuit is removed, the PTC thermistor automatically returns to a state of low impedance and the circuit becomes operative again.

The chip package provides not only a reduction in space requirements and low-cost automatic assembly, but also a minimal tolerance of operating values due to the consistent heat contact across the solder tabs The dimensions of the PTC thermistor chips range from 2 × 1.3 × 1 mm for the A701 to 6 1 × 5 3 × 2 mm for the A709 series



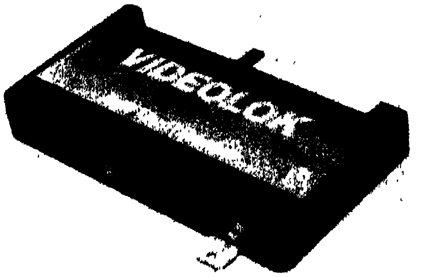
MINIATURE PTC THERMISTORS

Contact Siemens AG, Zentralstelle Fur Information, Postfach 103, D-800 Munchen 1, FRG

ANTI-THEFT VIDEO LOCK

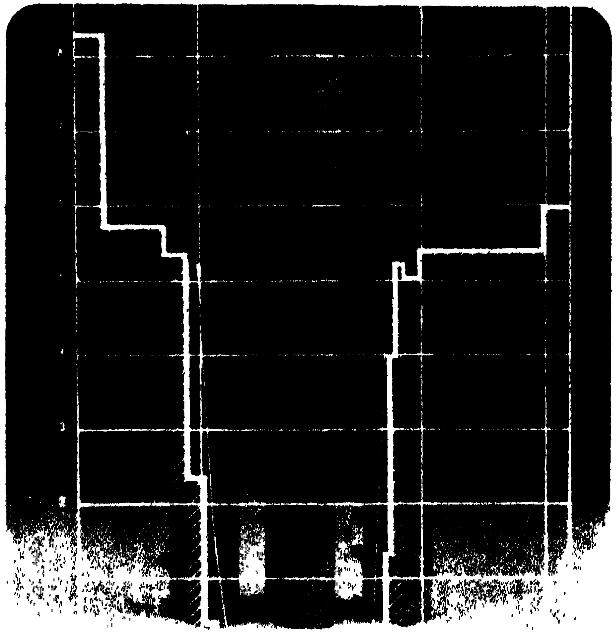
Videotek, UK has introduced a new Video Anti-Theft device, Videolok which has an added advantage of locking the video recorder to stop unauthorised viewing.

The simply operated unit is designed for VHS video recorders and comes in the shape of a VHS cassette. This is slipped into the video and locked in with a key. The action of turning the key not only locks the cassette into position, but also sets an alarm. After 15 secs. or so, if the recorder is moved the alarm will activate and will stay that way, emitting a shrill scream. The alarm will stop and reset itself when the VCR is stationery.



ANTI-THEFT VIDEO LOCK

Contact: Videotek Ltd, Unit 20/21 Royal Industrial Estate, Jarrow, Tyne & Wear, NE32 3HR, England.



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The intermediate frequency of your sets has it 200 kHz or 455 kHz, thus we supply a complete assortment of mechanical filters to you, by means of which you can realize all receiving widths required for the different modes of operation. Our filters are fitted with piezoelectric transducer granting you low intermodulation.

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This collection of articles and projects on microprocessors, which appeared in Electronics For You during the years 1981 to 1984, is likely to benefit a number of new readers as well as those who missed some of the issues carrying these articles.

You can buy a copy of the book for Rs 30 from some prominent bookstalls, or obtain it directly from us by mail. Please add Rs 5 for despatch by registered mail to ensure receipt.

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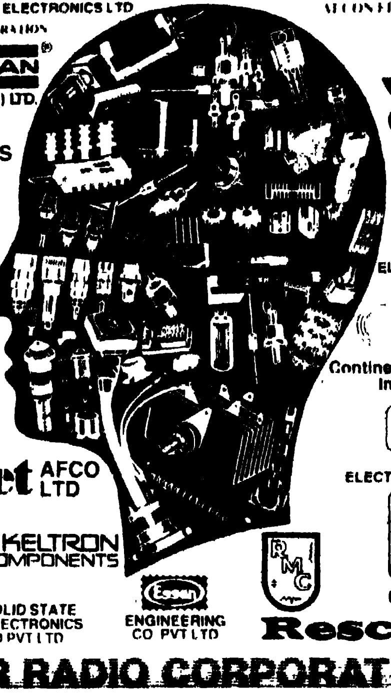

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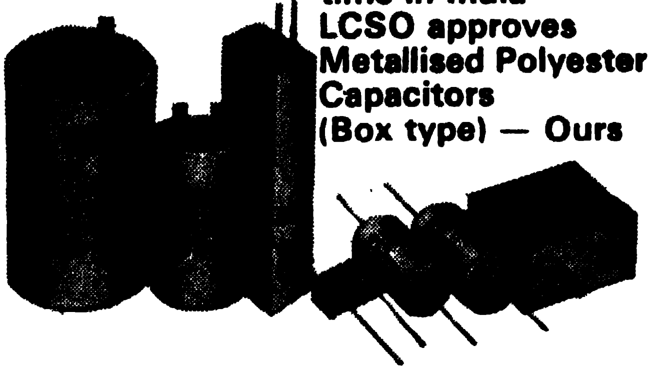

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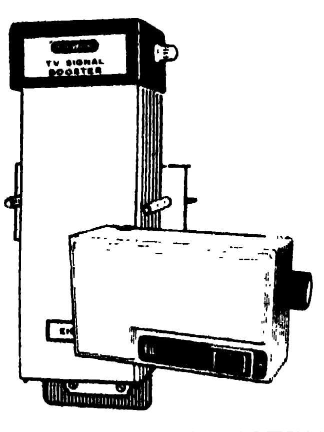

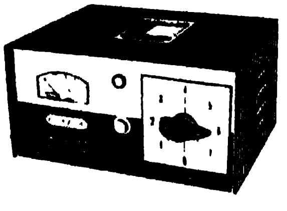

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Company Profiles.

Vimaltape expands

Vimal Enterprises has increased its production capacity for audio magnetic tapes, four-fold to 1200 million running metres annually.

Vimal has been pioneer in the industry to produce indigenous magnetic tapes without any foreign collaboration and the only unit to achieve ISI marks for its open reel tapes and also a major indigenous source for audio cassette industry. With the addition of latest machinery and equipments and modified formulations as per updated international technology based on latest developments in oxides, the company is set to achieve the sanctioned capacity during the year 1985-86. This is expected to reduce foreign exchange drain on imports as the company plans to pass on the cost benefits, resulting from higher production, to the consumers.

FICCI Award to L&T

Federation of Indian Chambers of Commerce and Industry has conferred on Larsen & Toubro Limited (L&T) its 1984 award in recognition of corporate initiative in research in science and technology in the field of industrial electronics. The award was presented by Mr R. Venkataraman, vice president of India at FICCI's fifty-eighth annual session recently.

L&T was the first to indigenously develop industrial electronics equipment entirely through in-house R&D in the early seventies. Some of the important equipment arising out of this effort include power electronic equipment such as thyristor controlled DC and AC drives and AC power controllers, control electronics equipment such as IC-based and microprocessor-based control systems. Products developed by L&T's R&D have earned international recognition. L&T actively collaborates with national and international bodies on research projects.

New computer division for Rishi

JBM Systems, the computer division of Rishi International Exports, has entered the field of computer applications and provides consultation in basic planning, systems analysis and sophisticated software packages to various organisations.

The specialised areas of JBM systems are software development, data processing, computer technology on the one hand and management techniques in operation and application of state-of-the-art technology to different commercial and industrial operations on the other.

HESPL excels in computer SMPS

Hybrid Electronic Systems (HESPL) has successfully completed the designing and development of different models of switching mode power supplies (SMPS) and specialised uninterrupted power supply (UPS) systems for computer based systems.

Established in 1980, HESPL designs, develops and manufactures SMPS used in sophisticated electronic systems such as computers where necessity for regulated DC voltage, energy conservation, size, weight and low costs are of paramount importance. The company has already introduced its first SMPS model successfully.

HyTech represents Soldermatic

HyTech Services has been appointed as representatives in India for wave soldering machines manufactured by Soldermatic Equipment. Soldermatic range of wave soldering machines consists of three models with wave widths of 220, 305 and 380 mm. All models handle boards (or rows of boards) up to 430 mm long with standard carriers, or 508 mm long with extended carriers. They are equipped with foam fluxers, airpumps, ventilated hoods and are fully automatic in operation. The special flat solder wave gives outstanding performance, very low drossing and allows a level conveyor to be used, saving space and improving performance.

ABL to make capacitors

ABL Capacitors India Ltd, a new unit set up in Himachal Pradesh with an investment of 15 million, will manufacture various types of plastic film capacitors.

The company has imported latest plant and machinery from Japan for its plant. The production capacity of the unit will be 25 million capacitors per year. The range of capacitors include plain polyester, polypropylene, polystyrene and metallised polyester.

The unit is expected to start its production by September this year and shall make capacitors of commercial and professional grade suitable for entertainment electronics, communication, and defence applications.

Sujata represents PMI

Sujata Sales and Exports Ltd has been appointed as the exclusive sales agent and representatives in India of Precision Monolithics Inc. (PMI), USA.

PMI designs, manufactures and markets precision, high-performance linear and data conversion integrated circuits using bipolar, laser trimmed and CMOS technologies. It supports the needs of the aerospace industry, instrumentation and process control manufacturers, defence and other users of high quality precision devices.

Khandelwal signs agreement

Khandelwal Herrmann Electronics has signed a collaboration agreement with Siemens, West Germany for the manufacture of SCRs, triacs, diacs and diodes which are extensively used in TVs, VCRs, microprocessors, computers, telephones, telecommunications and other products.

A project for the purpose is being set up at Pitampur, near Indore, MP. The cost of the new plant with Siemens' collaboration is estimated to cost Rs 80 million. The commercial production is expected to start by the middle of 1986.

Uptron to make CTV tubes

Uptron, the state-owned electronics corporation of Uttar Pradesh, has signed a memorandum of understanding with Toshiba of Japan for manufacturing the 'blackstripe, midneck' colour television picture tubes.

Uttar Pradesh is the first among the three states, (UP, Punjab and Andhra Pradesh), which have been granted letters of intent for manufacturing colour TV picture tubes. This will result in saving a very large amount of foreign exchange of about Rs 600 million every year.

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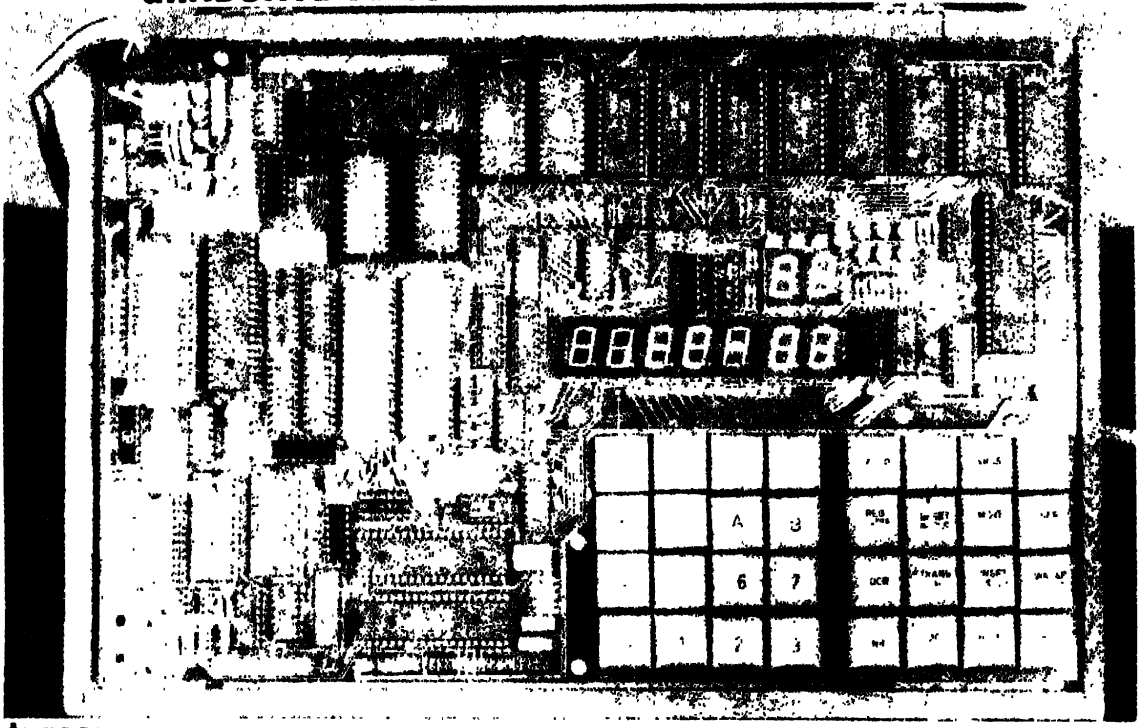

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- Facility to program 2716/2732/2732A/2764
- RS232C/20mA serial communication interface

☐ **IEC-TIM 8085A based and IEC-T2M Z80 based and IEC-T3M 8086 based Trainers**

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- Audio cassette interface
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- Facility to use 2716/2732/2764/6116/6264 (Selection thru DIP soldering pads).

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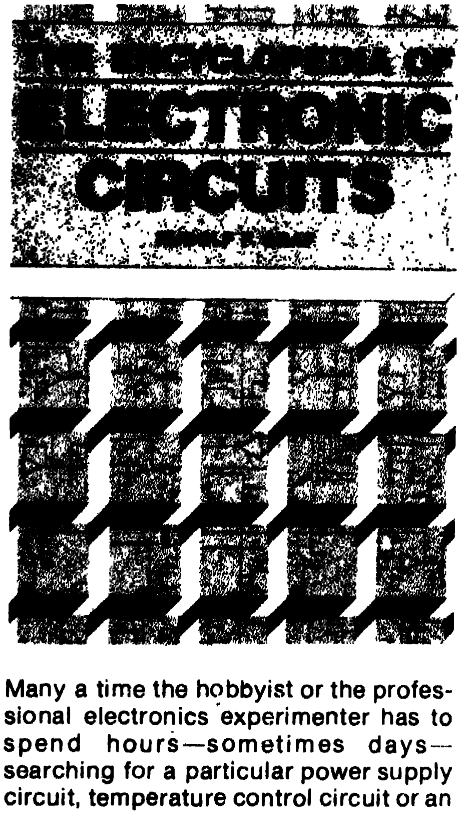
Book Reviews

The Encyclopedia of Electronic Circuits

By Rudolf F. Graf, published by Tab Books Inc., USA; pages 768 (18.5 cm × 23.5 cm); soft cover; price: US $ 29.95.



Many a time the hobbyist or the professional electronics experimenter has to spend hours—sometimes days—searching for a particular power supply circuit, temperature control circuit or an audio power amplifier circuit which fulfills his need for a certain type of electronic circuit. Sometimes even after he has finally located a circuit, the project builder may either have to presume that the circuit will work properly or he has to spend precious time on trial-and-error testing.

The need for a reference volume incorporating standard as well as creative circuits is covered by The Encyclopedia of Electronic Circuits, which is a virtual treasure-house of such circuits. Comprising of nearly 1300 detailed circuit schematics on 98 different categories, the book has a collection of circuits culled from several periodicals and journals.

The circuits are alphabetically arranged for convenience of easy reference. The project builder can get quick, reliable answers to specific design problems. Along with circuit schematics, wherever further clarification seems necessary, the author has given clear, concise explanations of the circuit configuration and functions.

The basic circuit categories, both analogue and digital, which have been incorporated in the volume include amateur radio circuits, alarms, amplifiers, filters, logic circuits, DA converters, crossover networks, gas/metal detectors, fixed and variable power supply circuits, radiation detector circuits, video circuits, oscilloscope circuits, probes, transmitters, schmitt triggers and zero crossing detectors.

The book has an index listing all the sources from which the various circuits have been chosen. Another index gives the hobbyist instant access to the exact circuit data which is required. All in all, the volume is an invaluable reference tool for every hobbyist, technician, student and design professional.

—R.B.

Master Guide to Service Korean Colour TV

By Desai and Desai, published by Jeevandeep Prakashan, Bombay; pages 76 (18.5 cm × 27.5 cm); soft cover; price: Rs 25.

With the advent of colour television in India, the market has been inundated with various brands of television sets with imported colour picture tubes. The most popular among such CTV tubes to be used by the manufacturers are the Korean 'Gold Star' and 'Sam Sung' brand picture tubes.

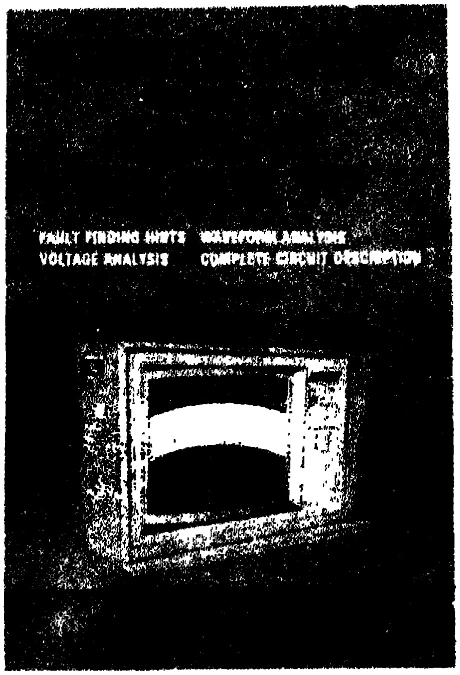
The Master Guide to Service Korean Colour TV is a technical manual to facilitate the servicing of Indian colour TV sets like ECIL, Dyanora, Texla, Keltron, Uptron and Televista.

The book has been divided into eight chapters. Chapter one explains the PAL colour television system while chapter two is an introduction to the block diagram of the colour receiver. The third chapter describes the major circuit features in the 'Gold Star' and 'Sam Sung' models.

Chapter four gives the complete circuit description of various parts of the TV set including power supply, picture IF amplifier, the various video amplifiers, sound IF/FM detector and audio amplifier stage, chroma IC circuit, picture tube circuit, synchronous separator, AFC and horizontal oscillator circuit, convergence circuit as well as channel selector system

Chapter five deals with installation and service adjustments while chapter six describes voltage measurements and waveform analyses. Common faults and fault finding hints are given in the next chapter. The last chapter deals with the use of CRO for studying the chroma circuit

Instead of dealing with the basic theory of colour television, the book explains the entire circuit description of the colour TV set and in doing so assumes that the reader has a sound grounding in TV theory and practice. The book also includes a complete circuit and block diagram of the colour receiver on a separate sheet to facilitate the service engineer. While the production of the book leaves a lot to be desired, it will prove helpful to CTV servicing personnel.



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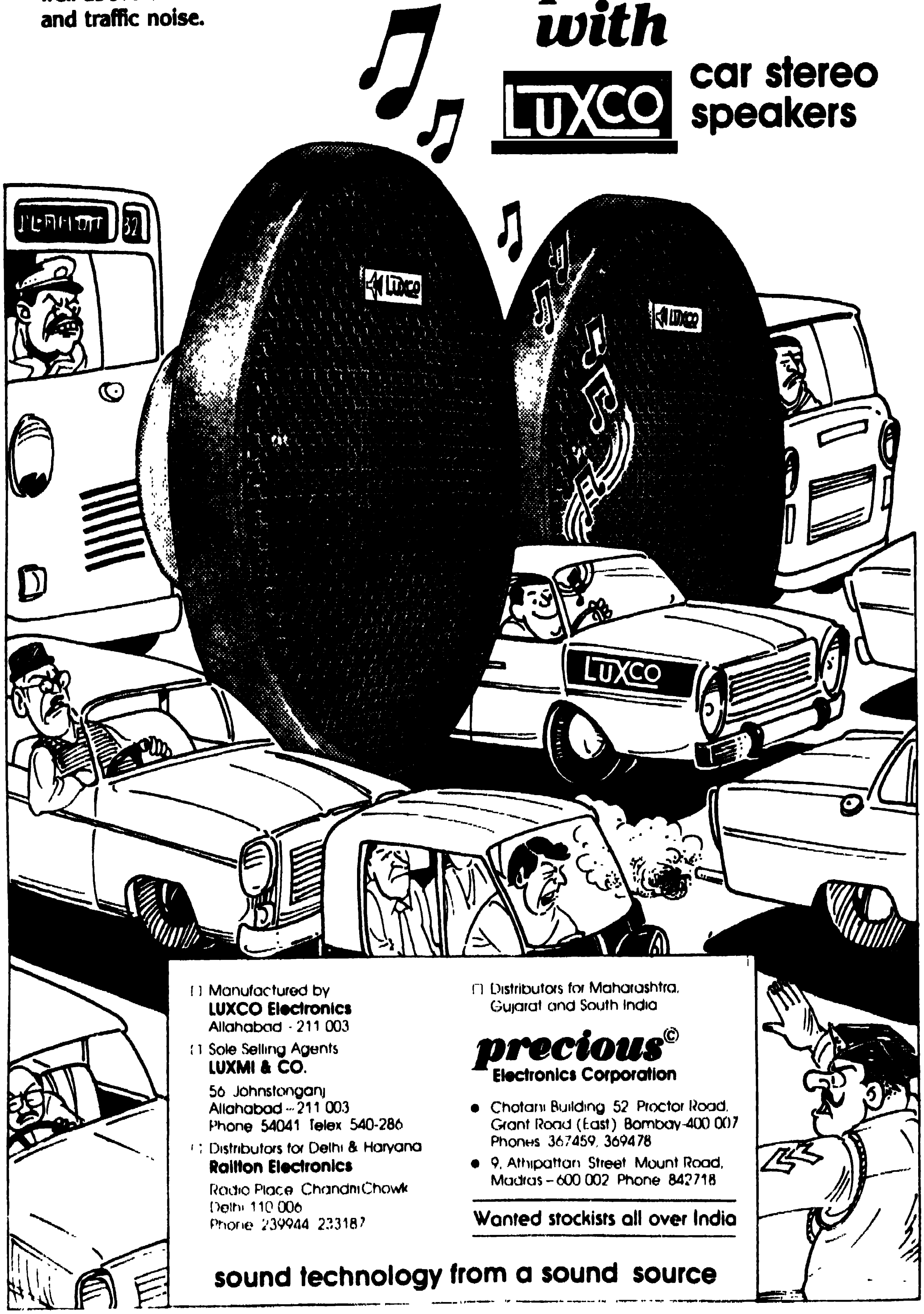

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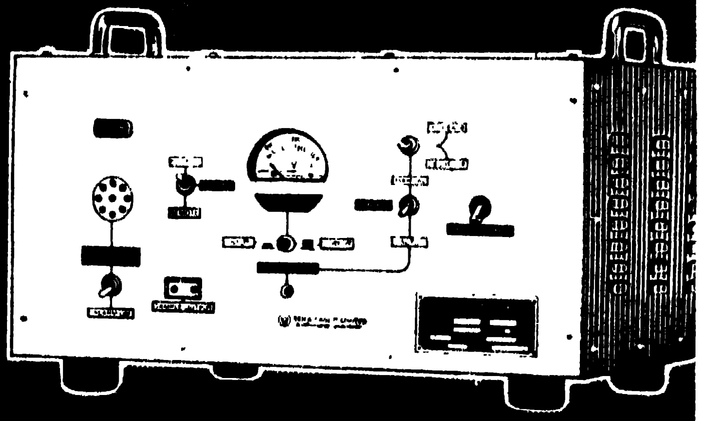

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Facts & Figures

FOREIGN COLLABORATIONS

(Approved between January-March 1985)

Name & Address of the Indian Firm (1)	*Name & Address of the Foreign Firm* (2)	*Item of Manufacture (Nature of Collaboration)* (3)
Ambalal Sarabhai Enterprises Ltd Wadi Wadi, Baroda 390007	CGA Alcatel France	Mini- and microprocessor based systems and computer peripherals and also manufacture of new articles in computer peripherals (Technical)
Dynacraft Machine Co Ltd C D Barfiwala Marg, Andheri West Bombay 400058	Herweg GmbH West Germany	Electronic readers/screw weighers, electronics less in weight feeders etc (Technical)
Andhra Pradesh Electronics Development Corpn Ltd 5th Floor, Parisrama Bhavanam, Basheer Bagh Hyderabad 500029	Shinwa Tsushinki Ltd Japan	VHF/UHF two-way communication projects (Technical)
G P Electronics Ltd Administrative Building, Morarji Mills Dr Ambedkar Road, Parel, Bombay 400012	Tokyo Kikai Sangyo Co Ltd Japan	Hard ferrites (Technical)
Kerala State Electronics Development Corpn Ltd Keltron House, Vellayambalam Trivandrum 695033.	Murata Mfg Co Ltd Japan	Ceramic capacitors (Technical)
Punjab Wireless Systems Ltd B-53, Phase VI, SAS Nagar (Mohalli) Chandigarh 160055	Japan Radio Co Japan	Long range radio communication equipments (Technical)
Peico Electronics & Electricals Limited Shivsagar Estate, Block 'A' Dr Annie Besant Road, Worli Bombay 400018	Philips The Netherlands	Automated scientific instruments for analytical applications (Technical)
Peico Electronics & Electricals Limited Shivsagar Estate, Block 'A' Dr Annie Besant Road, Worli Bombay 400018	Philips Holland	Critical components for colour TV receivers etc (Technical)
Peico Electronics & Electricals Limited 7 Justice Chandra Madhab Road Calcutta 700020	N V Philips, Gloelampen Fabrieken Holland	X-ray diagnostic systems (Technical)
C Padmanabhan 4 Gopalkrishna Road, T Nagar Madras 600017	Black and Peter Switzerland	Fire and burglar proof vaults etc (Financial)
Electronics Corpn of India Ltd Industrial Development Area, Cherlapalli Hyderabad 500762.	BBC Switzerland	Computer based electrical load despatch systems (Technical)
Kerala State Electronics Development Corpn Ltd Keltron House, Vellayambalam Trivandrum 695001.	BBC Brown Boveri & Co. Switzerland	High capacity uninterruptible power supply systems (UPS) (Technical)
Modern Alarms & Electronics Pvt Ltd 409 Meghdoot, 94 Nehru Place New Delhi 110019	Intruder Alarms Supplied Ltd UK	Electronic fire and burglar alarms (Financial)

(1)	(2)	(3)
Anupam Electronics Pvt Ltd D/12 Nandanvan Industrial Estate, L B Shastri Marg Thane, Maharashtra 400604.	Bausch & Lomb USA	Digital readouts (Technical)
AVX India Electronics Pvt Ltd Units 89-92, SDF III, Santacruz Electronics Exports Processing Zone, Andheri (East) Bombay 400096	AVX Corporation USA	Multilayer ceramic capacitors (Financial)
Dr B.K. Modi 36 Amrita Shergil Marg New Delhi 110003.	Diablo Systems Inc USA	Computer printers and sub-assemblies etc in SEEPZ (Financial)
CRID Limited Sardar Patel Hall Premises Bhubaneswar 751009	NCR Corporation USA	Proof encoders, passbook printers and minicomputer microprocessor based systems. (Technical)
Electronic Printers Ltd 138 New Colony Jaipur 302001.	Santee Corporation USA	Matrix printer (Technical)
Essen Electronics B 52/54 Nand Bhavan Industrial Estate Mahakali Caves Road, Andheri (East) Bombay 400093	1. Digital Equipment Corpn. USA 2 American Telephones & Telegraph Co USA	Operating software in source code (Designs & Drawings)
Godrej & Boyce Mfg Co. Pvt Ltd Godrej Bhavan, 4-A Homi St. Fort Bombay 400001	North Atlantic Industries Inc USA	Dot matrix printers (Technical)
Industrial Systems Division The National Radio & Electronics Co Ltd Mahakali Caves Road, Ghakala, Andheri (East) Bombay 400093	Emerson Electro Co USA	Solidstate inverters (Designs & Drawings)
Jay Electric Wire Corpn 202 Maker Tower-E, 20th Floor, Cuffe Parade Bombay 400015.	Molex International Incorporated USA	Professional grade connectors (Financial)
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Straw Products Ltd Nehru House, 4 Bahadur Shah Zafar Marg New Delhi 110002.	Media Technology International USA	Substrates for rigid disc media (Financial)
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Tie India International Ltd 21 Commerce House, 15 Ropewalk Street, Fort Bombay 400023.	Tie/Communication Inc USA	Fully electronic private automatic branch exchange (EPABX) etc (Financial)
Uptron India Limited 10 Ashok Marg, Lucknow 226001.	Leads & Northup USA	Microprocessor based electronic modules etc (Technical)

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Western India Erectors Ltd Sahyadri Sadan, Tilak Road Pune 411036	Extel Corpn USA	High speed near letter quality dot matrix printers with send/receive facility and message preparation, communication and data retrieval terminal for private wire operation and computer applications (Technical)
Raghav Bir Sawhney 3633 Subhash Marg New Delhi 110002	Pepperl & Fuchs ~~Beter~~ligungs GmbH West Germany	Proximity sensors, buffer amplifiers and zener barriers (Financial)
Universal Comtronics Pvt Ltd C-3/13 Safdarjung Dev Area New Delhi	Tok~~yo~~ Electric Co ~~Japan~~	Electronic typewriters (Technical)
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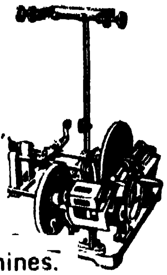
coil winding machines



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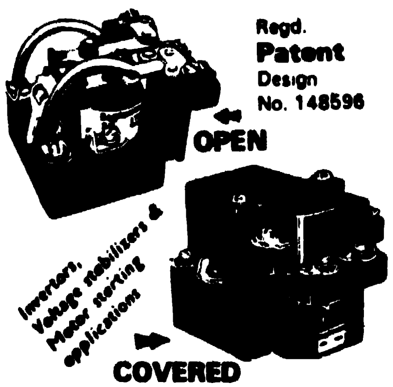
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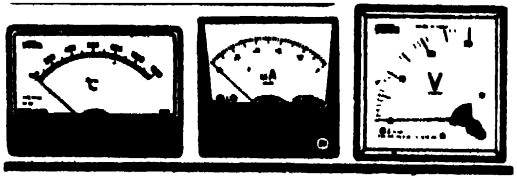

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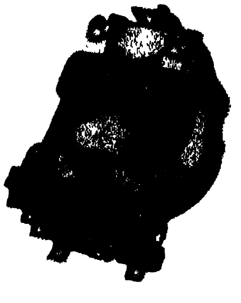

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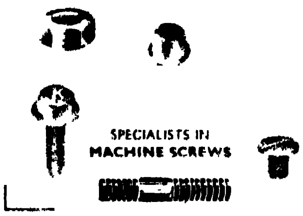

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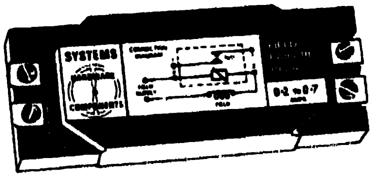

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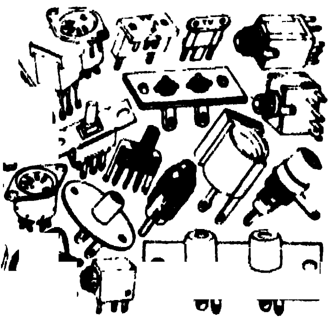

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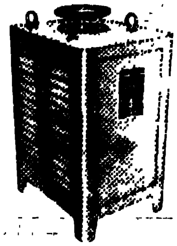

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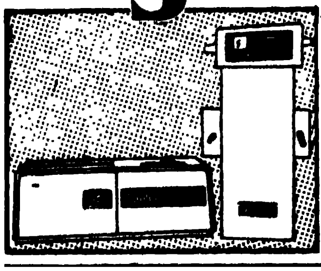

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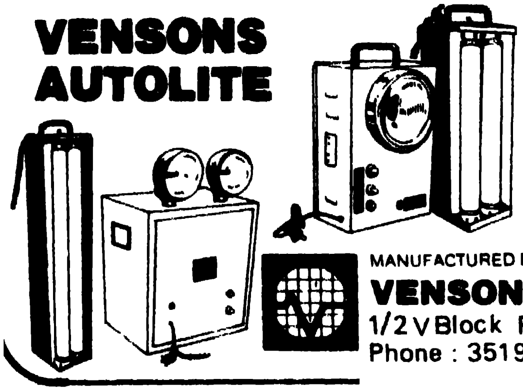

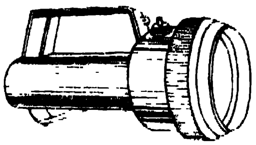

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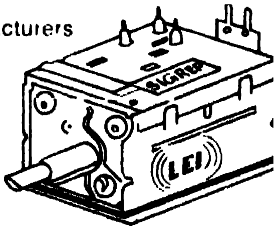

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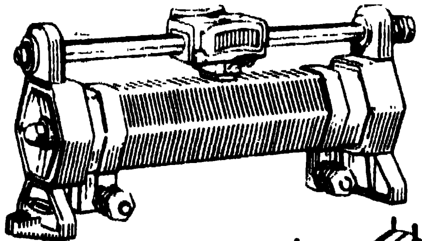

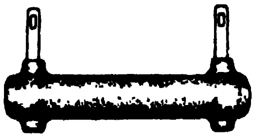

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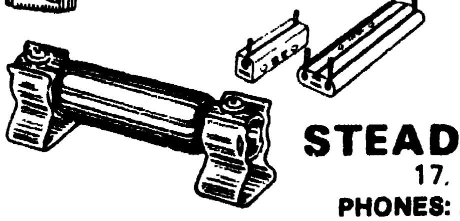

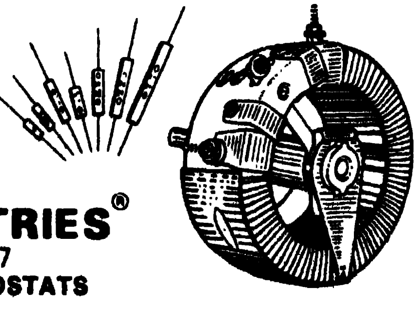

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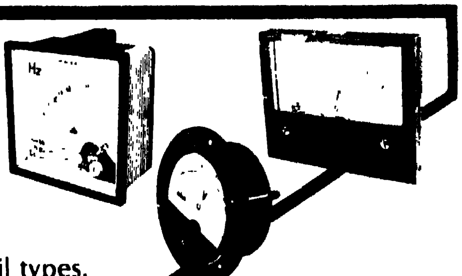

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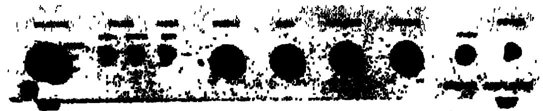

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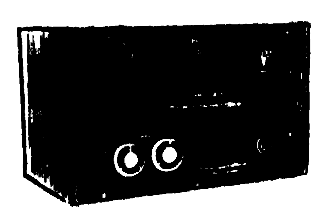
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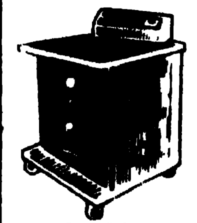
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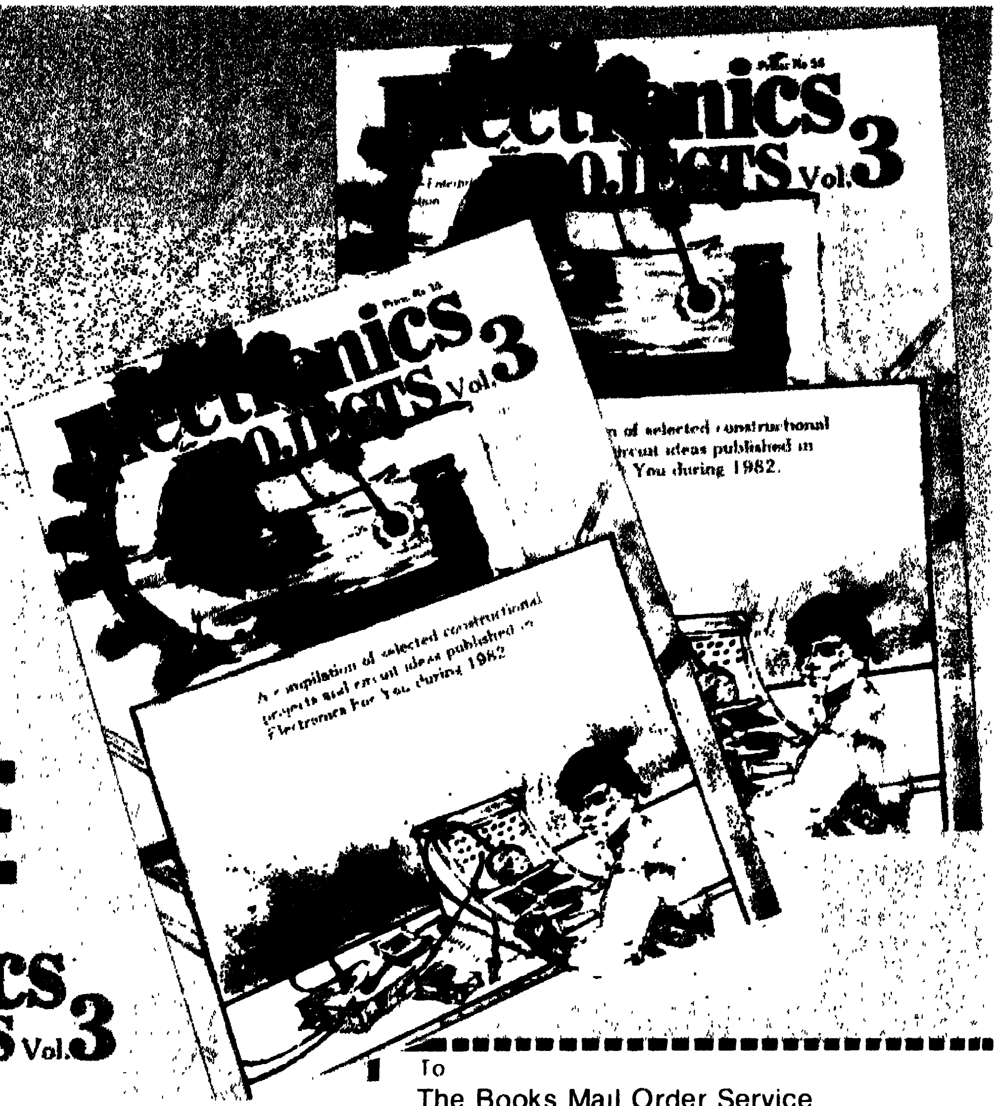
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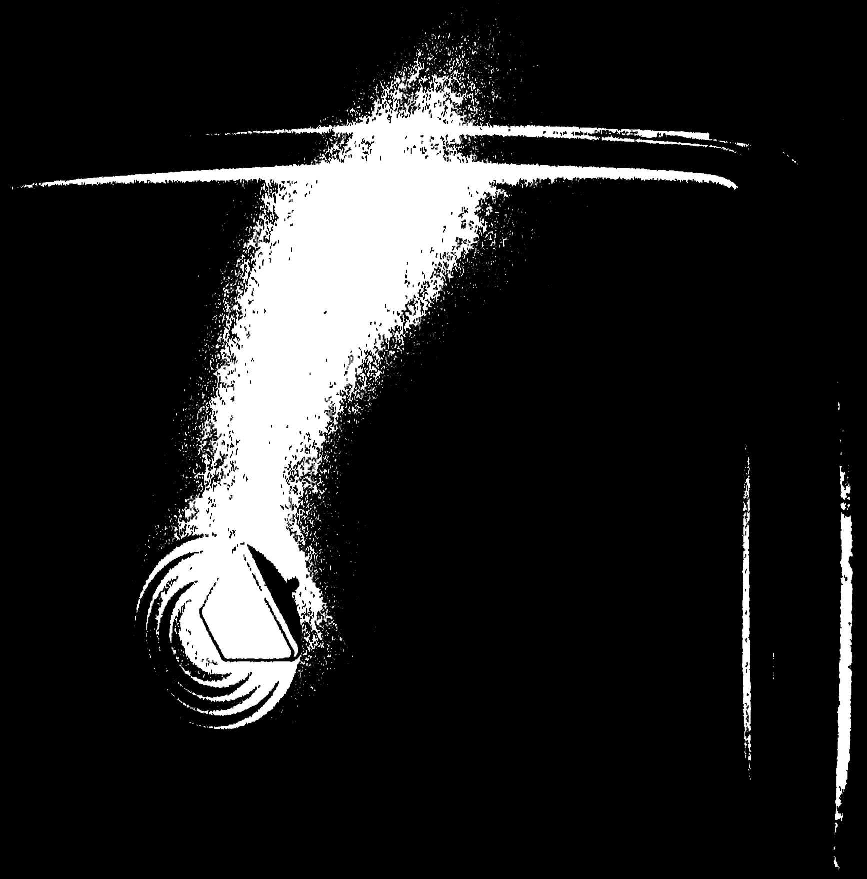

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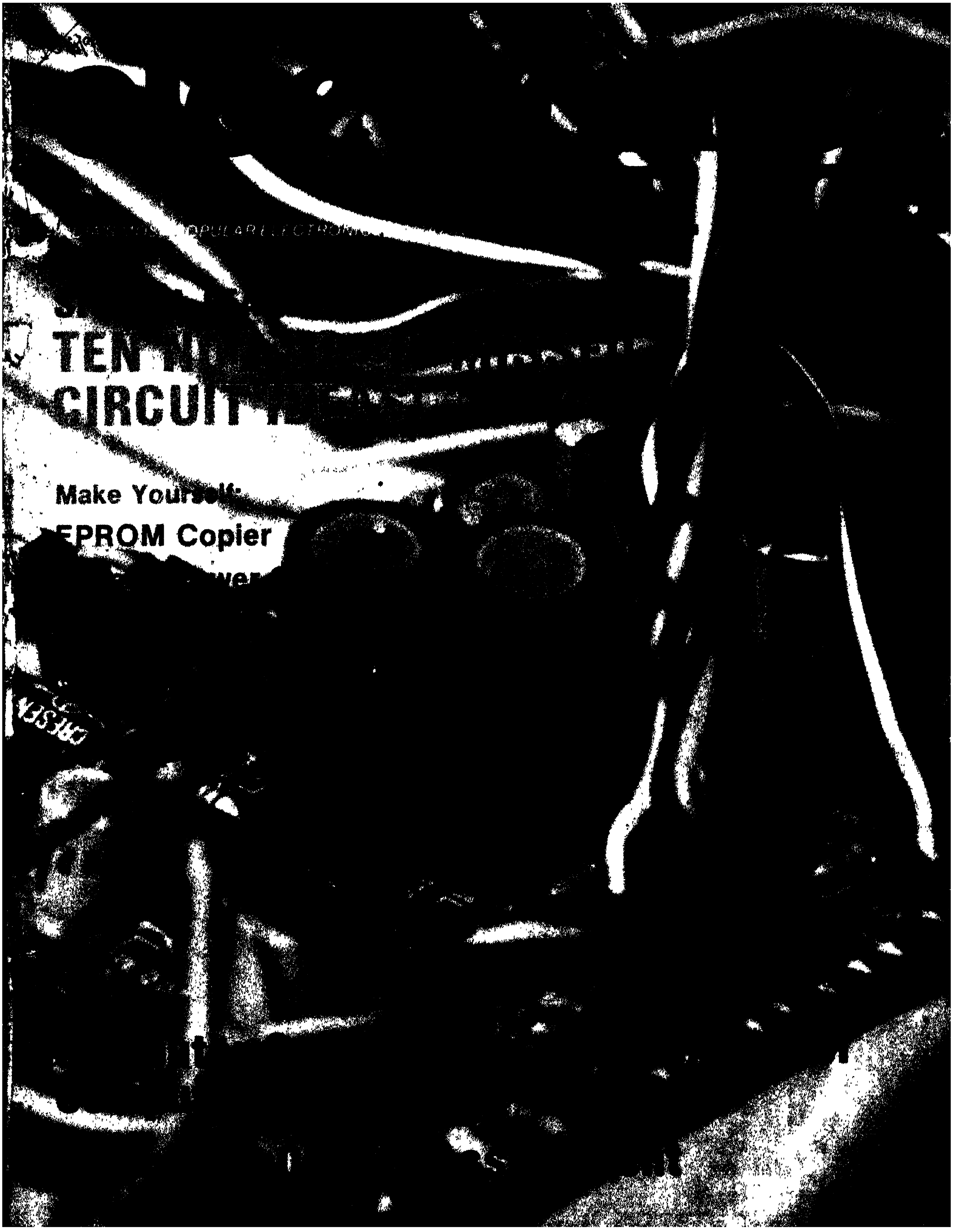
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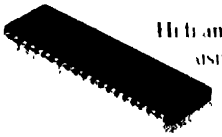

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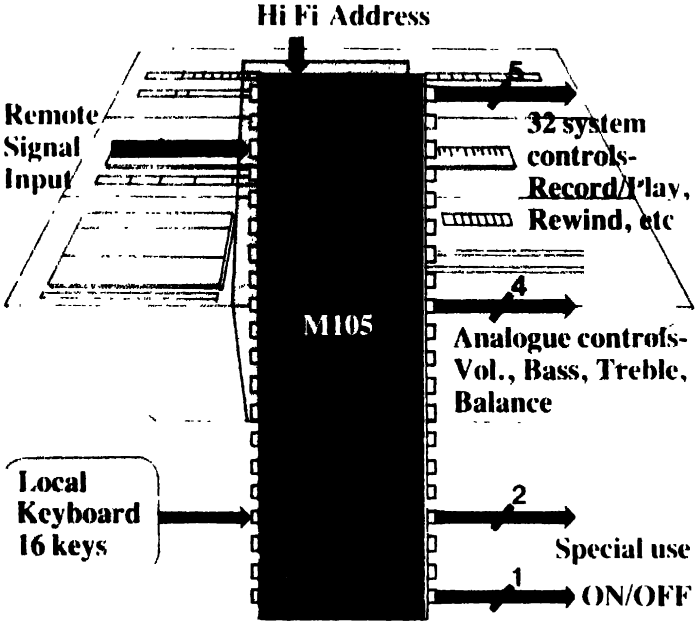
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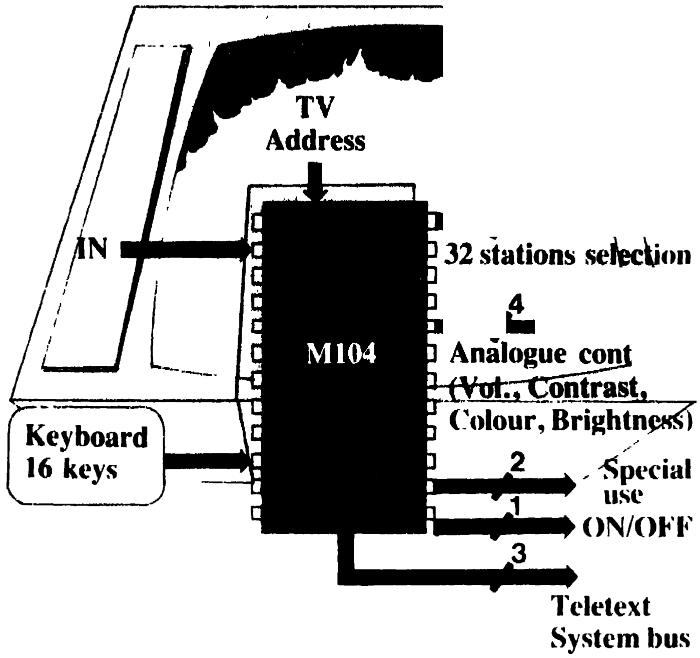

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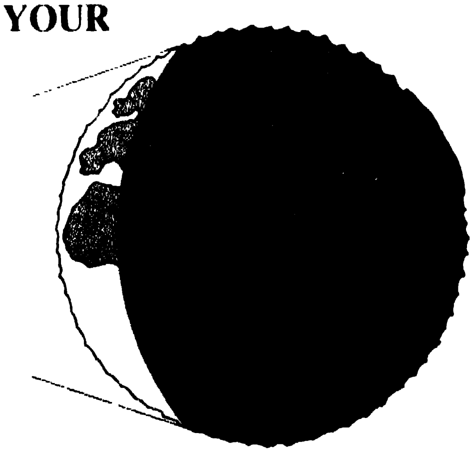

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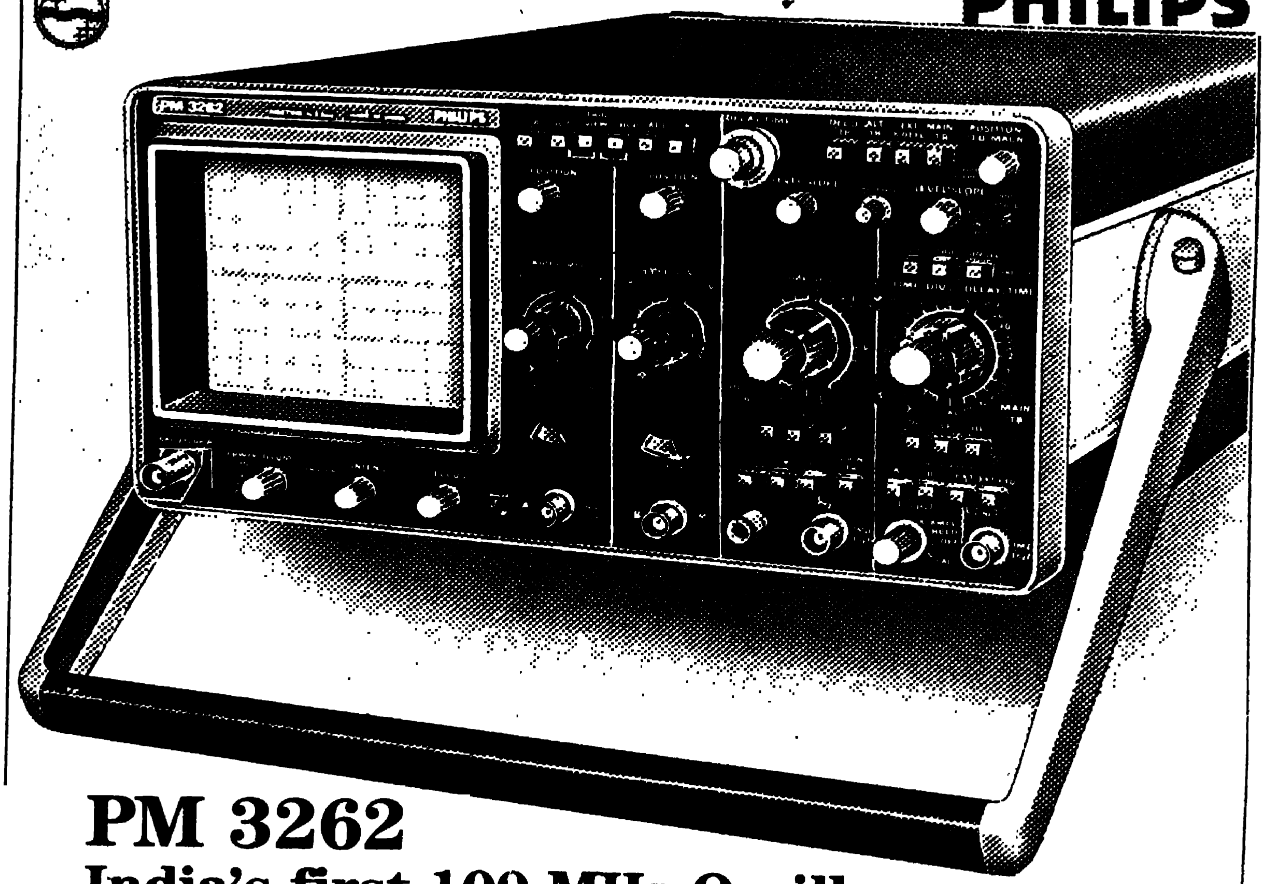

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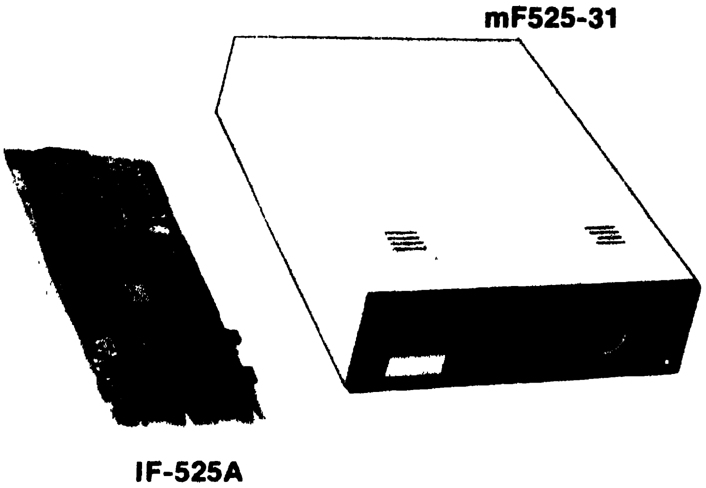

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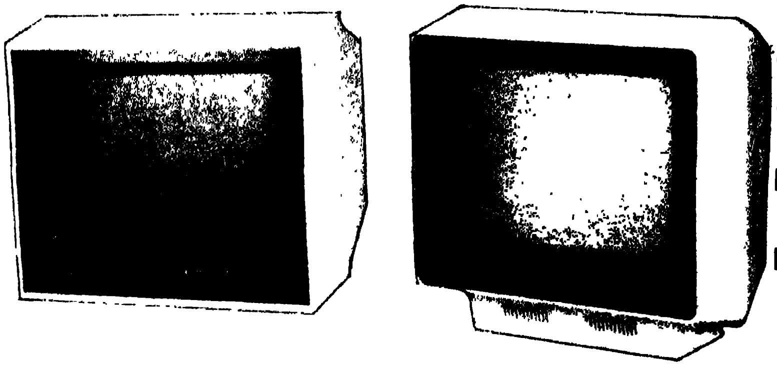

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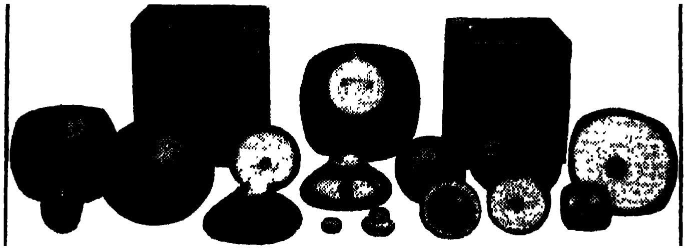

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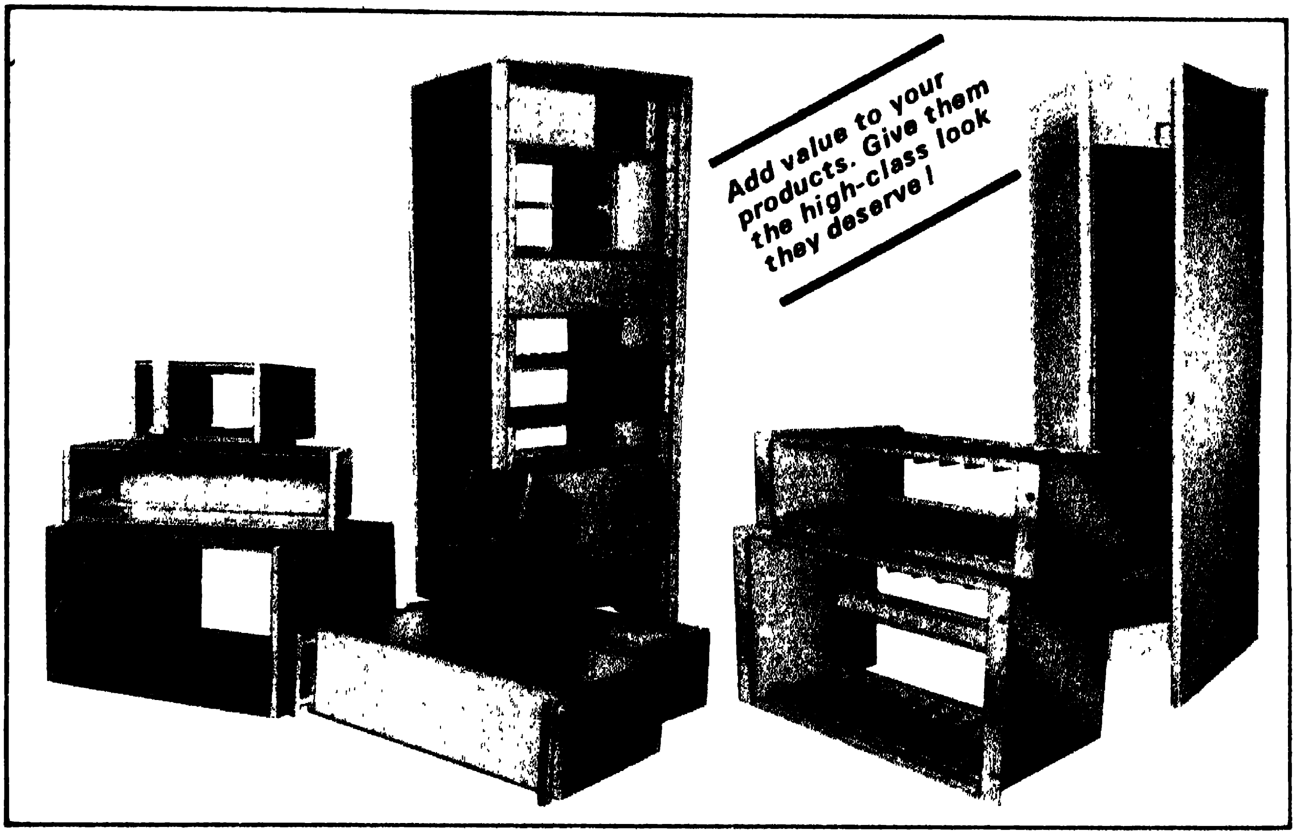
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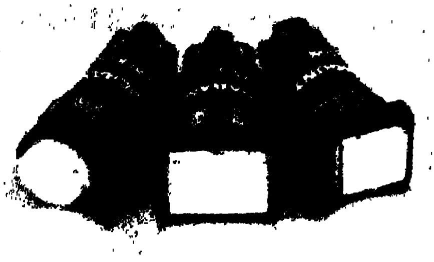

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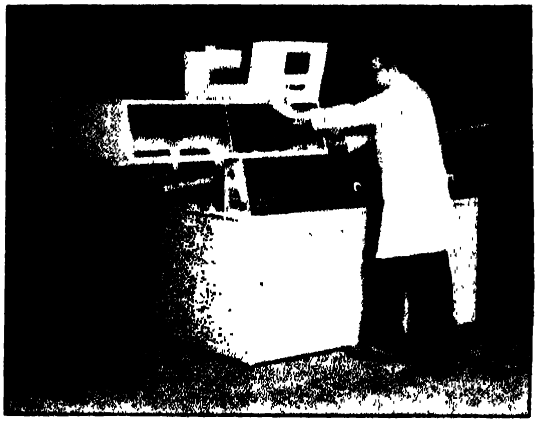

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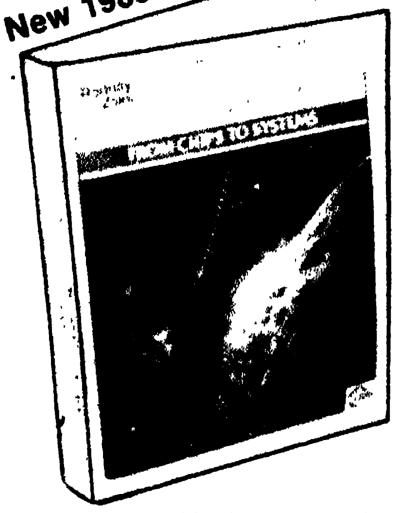

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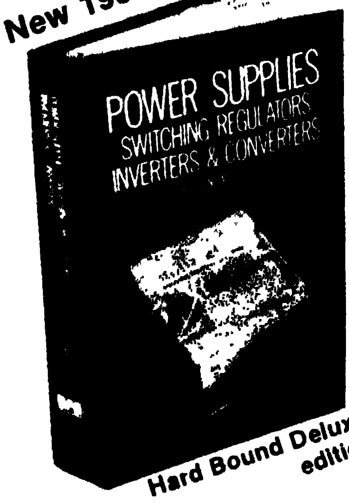

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Vol. 17 No. 9 SEPTEMBER 1985 ELECTRONICS FOR YOU

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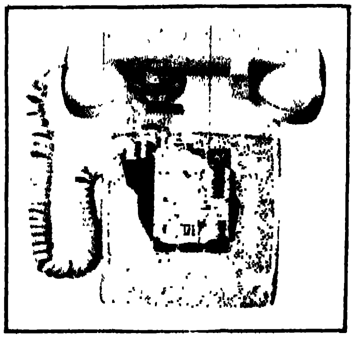
Circuit Ideas

Here's the much awaited special feature of ten exclusive circuit ideas for the EFY reader Now you can make 'de-thump circuit' for AF amplifiers, electronic auto dipper, listening bug, mind reader, IC fuzz for guitars, power failure indicator or call bell with memory. This feature is sure to give several buzy hours for the electronics enthusiast



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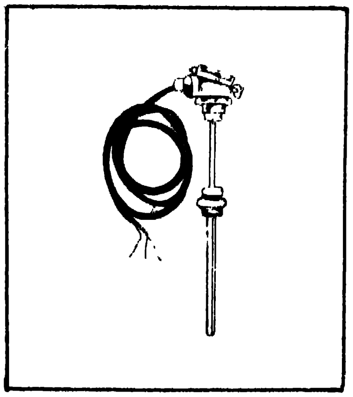
Telephone Quality Assessment

Till now, the transmission quality of telephones has been assessed on the basis of subjective parameters. Yet the purely objective type electro-acoustic method is also not fool-proof This article discusses the various methods used and gives the broad outline of the new parameters for telephone quality identified by CCITT.

—*B.L.K. Rao and T Usmani*



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Temperature Controller

Resistance temperature detectors (RTDs), thermistors, solidstate devices, thermocouples etc are well known as temperature sensing elements which are used in temperature controlling devices. These controllers have diverse applications in process control, and heating and air conditioning circuits. This construction project explains the design of such temperature controllers with a defined band of temperature

—*Krishna Gopal*

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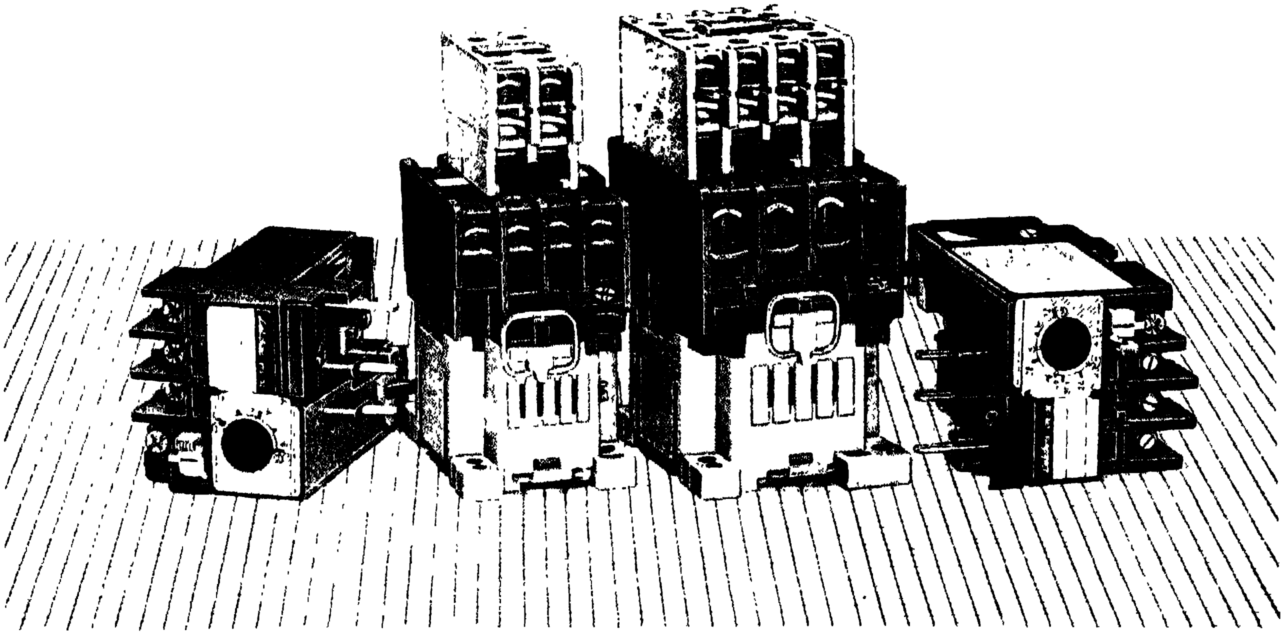

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Letters

Cassette Copier

It is heartening to find at least one magazine which has 'matured' constructional projects along with informative theoretical ones. Yes, I'm refering to Mr Sharma's article on Tape Cassette Copier (May 1985).

I have certain questions which I'm sure will interest other readers as well:

1. Mr Sharma had designed the copier for blank tapes. (Hence the minimal erasure and DC supply to the erase head) What if old tapes requiring more erasure are to be used? Should the EH be connected to the bias oscillator for complete erasure?

2. The frequency de-emphasis network employed: what is the formula used? Due to the superb performance of the deck, I wish to try out the premium tapes available - chromium dioxide and metal formulations But to do so it is necessary to alter the bias and the equalisation de-emphasis, and hence the time constant, and have the appropriate selector switches For the playback equalisation, a pair of components (usually a capacitor and a resistor in parallel) determine the 120μs time constant The time constant equals R times C; if a 12-kilohm resistor and a 0.01μF capacitor are combined the time constant is $10^{-8} \times 12 \times 10^{3}$ which equals 120×10^{-6} or 120μs. Changing the value of the resistance to 6.8 kilohm (by the selector switch) will bring the time constant close to 70μs required for chrome tapes Here it is slightly different, and I'm sure Mr Sharma had calculated the appropriate values for normal ferric oxide tapes. I would like to know which components should be altered to modify the deck/cassette copier. I invite further correspondence from other readers in this matter

3. Further, Mr Sharma used a buffer amplifier IC1 (741) and another IC2 (also 741) as a metering amplifier, the use of amplifier to drive the meter becomes necessary as the peak signal level is 100 mV However, when I assembled the project the signal level (1000 Hz recorded at 'O' VU level) was found to be 1.85 V(!)—clear and undistorted—and had to be scaled down by a 68-kilohm resistor in series to a lower level so as not to overload the power amplifier. Hence, the buffer amplifier in the control module was found undesirable. I would like to know if the other readers and serious audiophiles reached similar conclusions.

Do keep such articles coming and keep up the good work!

MAYANK BHARGAVA
New Delhi

Imports By Individuals

This refers Mr Deepak Dutta's letter in March issue.

Import of electronic spares (not consumer electronic items) is permitted only under Section 11(gg). Please note that these imports are not rendered duty-free. One has to pay the duty as demanded by the customs authorities, unless the item is imported as a sample or as a gift.

Earlier, I was also misled by Section 11(gg) and imported items worth Rs 900 for which I had to pay a duty of Rs 1250/ (140%). Though I have paid the amount under protest, I couldn't recover it

The amount has recently been raised from Rs 1000 to 1250 for import of samples and gifts.

As Mr Deepak Dutta says, please publicise this section but with a caution that these imports are not duty free!

The procedure is as follows:

1 Obtain an invoice/quotation from the dealer of the item. The cost should be within Rs 1250, including postage and other charges.

2. Fill form (A1 or A2) available with any bank dealing with foreign exchange. On remitting the amount, the banker would give a cheque/draft in foreign currency, payable at the dealer's place

3 Send the cheque/draft to the dealer.

4. Pay duty (depending upon the cost) and collect the item

If an individual feels that paying duty is not justified (which is often the case), he may file an appeal with customs, provided he pays the amount under protest.

It appears that Section 11 (gg) has a lot of ambiguity which are (mis) used by many

Hence please caution the readers

C. RAMA MURTHY
Hyderabad

Ham Radio Correspondence Course

Its a great pleasure to acknowledge the vast response I got for the article "Chak's Wonderland" published in June, '85 issue of Electronics For You Every alternate day I hear from OM Chakravarthy that some one or the other is visiting his place daily Even I'm getting letters from EFY enthusiasts

I thank all the EFY readers for showing a great interest in the Amateur Radio articles I once again apologise for being unable to send personal replies to all those who write to me for more information Unfortunately, these enthusiasts seem to be not regular EFY readers Because the information they want is already given in the back issues of EFY Hence, I request them to go through the same so that I can utilise the little spare time I get to answer genuine questions

Some of our EFY readers from the remote corners of India have written to me that they cannot join any club for preparing for the Amateur Station Operators Certificate (ASOC) exam I have a very good news for them. The Kerala Amateur Radio League (KARL) has announced the commencement of correspondence course for aspiring Short Wave Listeners in response to the large number of requests received by them.

The course will have 50 to 60 lessons altogether Mailing will be done at 5 lessons at a time. The fee is likely to be around Rs 100 and the course is expected to complete in six months time All members of KARL are eligible for substantial fee concession.

The lessons have been prepared for students having a minimum of SSLC standard Lessons start from the elementary electronics to advanced electronics, sufficient to appear for the ASOC examination confidently The answers to questions contained in each lesson should be sent with a self-addressed stamped envelope to OM L.V Sarma, VU2LV, Mukaleth Madom, Adur-691523 Mistakes will be pointed out and clarifications will be given, if necessary The arrangements for contact classes are being worked out

Those who are interested may register their names by sending Rs 25, being the first instalment, to OM P A. Mukundan, VU2DRL, Hon. Secretary, Kerala Amateur Radio League, Panamattom, Thonnalloor, Mevelloor, Kottayam District, Kerala 686609 The first five lessons will be mailed immediately on receipt of the registration fee

All demand drafts/postal orders should be drawn in favour of Kerala Amateur Radio League, payable at Cochin/Ernakulam The EFY readers are requested to make the best use of this opportunity Should you require any further details, please feel free to write to the Hon Secretary with a SASE

I JAGADHISWARA RAO
Hyderabad

Projection Television

With regard to the Projection Television article in EFY May issue, I desire further details of the project and the focussing lens used in it. Where can I get the lens?

ANAND M BHANUSHALI
Kalyan (C Rly), Bail-Bazar

The author, Mr B. Ramesh Reddi replies:

I appreciate Mr Anand Bhanushali's interest in Projection Television I would like to inform that the lenses are not available in India as a loose item Some suppliers in this field are supplying a complete assembly which is to be simply placed before the TV for projection Some manufacturers/suppliers are

Weston Available only in Madras through
M/s Asia Sales Agency
807, Mount Road, Madras

Krisons Electronics Systems Pvt Ltd
N-2, Connaught Place,
New Delhi 110001
Systematics (India), who give demonstration at.
Shop No. 30,
Ground floor,
Panchratna,
Opera House,
Mama Parmanand Marg
Bombay 400004
British Physical Laboratories, Bangalore

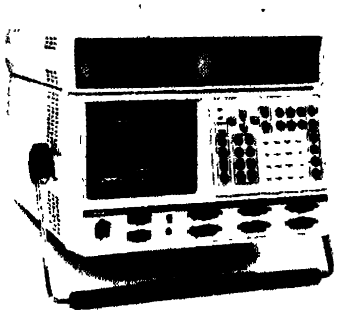
At least 10 persons/companies are issued letters of intent, and I would appreciate if anyone of them could give more details of their systems.

B RAMESH REDDI
Bangalore

The Gould Logic Analyzer Family

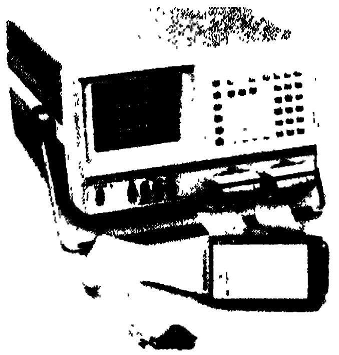
NEW HIGH SPEED DISCRETE CIRCUIT LOGIC ANALYZER

The powerful K205 Logic Analyzer is designed to provide high performance and versatility along with ease of use The instrument permits recording on 48 channels with 10nsec resolution while capturing 5nsec glitches at 100MHz Four, eight, or 16 waveforms can be displayed simultaneously Internal clocking saves time and eliminates extra wiring while optional disk drives save data from intermittent failures Both ECL and TTL devices can be analyzed simultaneously Trace Control™ permits the sequencing of complex programs in the system under test with 16 decision levels and four commands in each level at the rate of four decisions every 20nsec



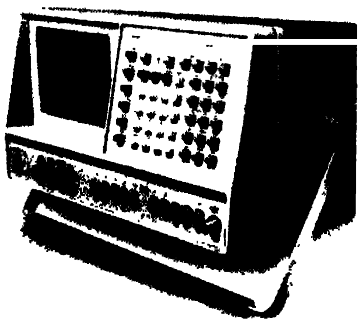
100MHz HARDWARE LOGIC ANALYZER

The Model K100 D Logic Analyzer is designed to improve the efficiency of analysis for practically any digital circuitry High performance recording, sophisticated triggering parameters, and comprehensive display analysis make the K100-D a very versatile analysis system Instrument control is via direct keyboard entry or programmable GPIB interface Complex timing and state analysis can be easily performed with standard high performance and specialized probe accessories Active hybrid probe circuitry ensures 5ns glitch capture, and as many as 16 channels of signal information can be recorded simultaneously into the 1024 word memory



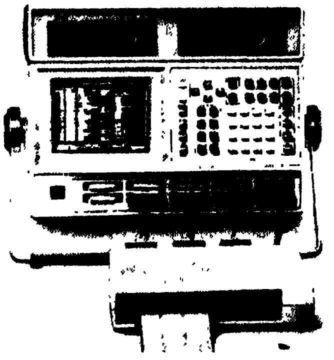
COMPUTER MAINFRAME LOGIC ANALYZER

The Model K500-D Logic Analyzer from Gould is a technological breakthrough that greatly aids the design and development of high speed digital circuitry. It clocks at 500MHz permitting timing measurements on up to 8 digital signals, with a 2ns resolution An internal 4-bit ADC makes it possible for analog recordings to be made at a 500MHz sample rate. A 2000 word memory makes precise timing measurements over a long period of time Instrument control is simplified as a result of the microprocessor linked front keyboard, and status display.



MICROPROCESSOR HARDWARE-SOFTWARE LOGIC ANALYZER

The Gould K105 D Logic Analyzer gives just the right combination of flexibility and user friendliness. It automatically recognizes the options installed, performs self-testing and identifies the configuration, in addition to the active and inactive inputs available User friendliness includes the ease of entering set-up parameters, the color-coded keyboard, human engineered displays and menu driven screens for scrolling the available choices within a field The K105-D answers questions about operating instructions for selected parameters or data displays Or a complete user's guide can be commanded from the instrument.



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RSA/TM/18/85

What's New.

IN INDIA....

India to make largest radio telescope

The world's largest giant radio telescope which might unfold the mysteries of the formation of the galaxies will be put up in Pune or Indore.

The giant metre-wave length radio telescope (GMRT) project, expected to cost Rs 200 million, will help in front-line research in a variety of fundamental problems in modern astrophysics.

The project is sponsored by the Udhagamandalam (Ooty) based radio astronomy centre of the Tata Institute of Fundamental Research.

This powerful telescope, proposed to be constructed during 1985-92, would be designed and constructed fully indigenously with an import content of less than 15 per cent.

Import of super computers

The possibility of procuring latest super computer Cray-XMP from United States is being explored. No specific proposal has, however, been made in this regard to seek the assistance. The government has, however, sought assistance of Japan for such computers.

The Indian Institute of Science (IISc) at Bangalore is planning to procure a super computer for its in-house use for which it has evaluated two super computer systems from the USA and one system from Japan. The computer system at IISc is expected to be used to enhance research capabilities in various front-line fields such as atmospheric sciences, crystallography, computer sciences, bio-engineering etc having national significance. The expected cost of the computer system with front-end processor, peripherals, software installation, one year warranty maintenance, training and documentation will be about Rs 300 million.

Manufacture of TV sets

68 letters of intent/industrial licences have been issued for manufacture of black-and-white TV sets in organised sector. In addition, a large number of approvals have also been issued by state directors of Industries as this item is decentralised Also, 174 letters of intent have been issued for manufacture of colour TV sets in organised sector as well as 794 small scale approvals have been issued to small scale sector.

The average monthly production of black-and-white and colour TV sets in the country is around 120,000 and 45,000 respectively.

Most of the components for black-and-white TV sets are being manufactured indigenously. In case of colour TV sets, all critical components are currently being imported However, certain items like loudspeakers, cabinets, PCBs, resistors and capacitors are being manufactured indigenously Imported components are mainly obtained from Japan, Korea, Germany, Holland, France etc. Electronics Trade & Technology Development Corporation (ET&T) has been importing colour picture tubes for distribution to indigenous manufacturers.

Computer advances in Haryana

A major computerisation programme is on the anvil in Haryana. At the instance of the state government, Haryana State Electronics Development Corporation Ltd (HARTRON) has drawn plans to cover the entire state with a network of computers in a phased manner.

To facilitate early implementation of the computerisation scheme in the state, HARTRON while waiting for the installation of the computer system of its own, is utilising the facilities of the regional computer centre. As a result, it has already implemented a number of computer applications.

The state computerisation scheme envisages setting up of computers in district towns of Ambala, Gurgaon, Kurukshetra, Hissar and Sonepat in the first phase which has already been initiated. The remaining districts of the state will be covered by computerisation in the second phase of the programme. Each district shall have a minicomputer with 512k of memory, a floppy drive, hard disc drives of 160MB capacity, a magnetic tape drive, a 300-lines per minute printer, three terminals and three off-line data entry devices. The whole programme is being implemented in coordination with Department of Electronics.

It is anticipated that the inculcation of the computer culture in the state will vastly improve planning and monitoring of projects, administrative efficiency and productivity in various sectors of the state like agriculture, industry, trade, health, education etc Further, it will help in spreading scientific culture in this predominantly agricultural state

CAD software developed

The computer aided designing (CAD) groups of the Indian Telephone Industries R&D centre, Bangalore, has developed a completely integrated CAD software system called 'Nirman' for optimum design of printed circuit boards, used in wide range of electronic equipment and system manufacturing

The innovative CAD software system enables designs of highly complex printed circuit boards in a fraction of time At the same time, it ensures accuracy, flexibility and reproducibility of electronic circuit design and layout

All the components of the CAD system have been developed on a general purpose computer system like the DEC-1091 They are all in high level languages with very little or no assembly codes. Only the auto router is in Fortran-IV and all other packages are written in Pascal, permitting efficient use of data structures. This results in programs with good response times.

The integrated CAD system is expected to solve all complex electronic circuit design and layout problems and assures data integrity, enhanced productivity and better quality designs at reduced costs.

ISRO offers knowhow

ISRO has offered technical knowhow for two devices developed by it to interested entrepreneurs. These are a 6GHz, 400W travelling wave tube amplifier (TWTA) and microprocessor aid to real time systems (MicroARTS).

The amplifier used in satellite communication earth stations consists of a solidstate driver amplifier and TWT for power amplification It includes control and monitoring circuits for high voltage and RF operations It also incorporates protection and tripping circuits to safeguard the system The amplifier, employing state-of-the-art design techniques, can be operated in either automatic or manual mode Other techniques employed are pulse-width modulation for regulation and digital techniques for control/protection circuits, keeping the use of electromechanical relays to a minimum.

· ISRO has also developed a general-purpose 16-bit microcomputer system (MicroARTS) featuring the Intel 8086 family for its launch vehicle checkout and real time data acquisition/data processing applications A totally indigenous design, developed from component level, ensures complete system integration from modular cards to any processor aided application Novelties in the hardware design include among use of Euro connectors (conforming to DIN 41612) for enhanced reliability, I/O connections through standard header connectors and flat-cables, and uniform system bus forming the back plane to provide 'slot' independency to the cards

Full details can be obtained from Manager, Technology Transfer, Space Application Centre, Jodhpur Tekra, Ahmedabad 380053 for the amplifier, and Manager, Technology Transfer, Vikram Sarabhai Space Centre, Thumba PO, Trivandrum 695022 for MicroARTS

IETE to hold two events

The Institution of Electronics and Telecommunication Engineers will be holding two major professional events the 17th mid-term symposium and the 29th technical convention

The 17th mid term symposium to be held on September 14 15, 1985 at Hyderabad will provide discussion on the theme of standardisation and reliability for excellence in production The symposium is expected to provide a common platform for delegates from industry, R&D laboratories and government departments An exhibition on electronics instruments, devices and systems will be held as part of the symposium to highlight the advances made by the industry and R&D labs

The 29th technical convention of the IETE will be held in January 1986 The six technical sessions comprising the convention will cover subjects like circuits and systems, communications including acoustics, speech processing and broadcasting, computers and control, electromagnetics including microwaves and antennae, electron devices and components; and instrumentation and measurement including industrial electronics Original, unpublished or unpresented papers are invited for the convention on the theory, application, design or performance of any of the above subjects by the Editor, IETE, 2 Institutional Area, Lodi Road, New Delhi 110003

SIS annual convention

The Society for Information Science (SIS) will hold its fifth annual convention and conference on December 9-11, 1985 at IIT, Bombay

The convention will have as its theme the use of microprocessors in information analysis and library applications Since this subject is deemed of great relevance in the fast changing situation in India in the field of communication and dissemination of science and technological information, the convention proposes to cover all aspects of microprocessors and their utilisation in detail

Complete details regarding submission of papers can be obtained from SIS, PID Building, Hillside Road, New Delhi 110012

ERDA for better electrical products

With Rs 30 million investment already made and many developmental projects on the anvil, Electrical Research Development Association (ERDA) is well set to upgrade the quality of electrical equipment and systems in India ERDA has collaborated with Laboratoire Central des Industries Electriques (LCIE), France in setting up a materials laboratory on its campus in Baroda

ERDA R&D and testing facilities and documentation centre at Baroda are of a high standard and would be of great help in upgrading the quality of materials and systems used in electrical industry in India The services of ERDA were available to all manufacturers, irrespective of whether they are members or not

In order to encourage the small sector to take advantage of ERDA facilities, they are offered a special concessional rate for membership. Interested enterprises may contact ERDA at Braboure Stadium, 87 Veer Nariman Road, Bombay 400020

International Svmposium on opto-electronics

The International Symposium on Opto-Electronic Imaging (ISOLI), being organised by Instruments Research and Development Establishment (IRDE), Dehra Dun, will be held in New Delhi during December 2-5, 1985.

The symposium which broadly covers various aspects of opto-electronic imaging, will provide an excellent forum for exchange of ideas amongst the international scientific community working in this rapidly expanding field. This will offer ample opportunity to take stock of the present state-of-the-art and to identify the grey areas for futuristic activities through interaction amongst the participating scientists and technologists.

Apart from techniques and instrumentation of opto-electronic imaging, the topics to be covered in the symposium include opto-electronic communication, materials, sensors and displays, design, fabrication and evaluation, image processing and future trends in the field. Further details for participation can be obtained from organising secretary (ISOLI), IRDE, Dehra Dun 248008.

.AND ABROAD

Computer China '85

With its modernisation programme gaining momentum, the Chinese computer industry is poised for giant leaps and is attracting the attention of international computer organisations In this connection, an exhibition - Computers China '85 is being organised at Beijing by Adsale Exhibition Services, Hong Kong in December

Computer China '85 is supported by both the China Computer Technical Service Corporation and China Computer Users Association. Among the participants will be the leading American and Canadian computer companies like Altos, Intel, Texas Instrument etc.

Details can be obtained from Unilam Pvt Ltd, PO Box 3744, 150 Mount Road, Madras 600002.

Old electronic parts found and Supplied

Old electronic equipment can still be maintained in operational condition with the help of a British company, Grolec Ltd, which specialises in supplying parts for telecommunications and other installations which are no longer in production —particularly those originally made in Britain.

The company concentrates on supplying obsolete devices like valves and has become particularly expert at locating rare parts. It recently sold a number of brand-new valves which were made in 1941.

In addition to semiconductor and other electronic items including transistors, Grolec holds extensive stocks of or can procure receiving, transmitting or industrial valves as well as integrated circuits, diodes, capacitors and resistors, fuses, transformers and relays many of which were made before 1965.

A fully approved supplier to British telecom and registered by cable and wireless plc as a supplier of semiconductors and valves, the company can also provide a wide variety of telephone exchange spares including electromechanical replacements All parts are subject to a quality control procedure which covers not only functional testing but also verification of correct marking, packing and documentation.

Wescon '85 at San Francisco

TDA is organising participation in Wescon '85 to be held in San Francisco (USA) from November 19 to 22, 1985. Wescon is a leading trade fair of the USA in the field of electronic components and equipment. It is organised annually by the Electronic Conventions Inc , Los Angeles (USA). Buyers from all over the world are expected to attend the fair.

It is for the first time that India will be displaying components and equipment. The products having potential for export in USA identified by TDA are electronic components like discrete semiconductor devices and ICs, resistors, capacitors, switches, relays, connectors, PCBs, circuit breakers etc, test and measuring instruments like CROs, frequency counters/generators, X-Y recorders, strip chart recorders, power supplies, and wire/cable/harnesses like wire, cable (assemblies), connectors, terminals, sockets etc

Further details can be obtained from Trade Development Authority, 16 Parliament Street, New Delhi 110001.

Voice-controlled TV camera

Siemens is displaying a voice-controlled TV camera for the first time at the '85 Hanover Fair to be held on October 17-25 Voice control in the form of a spoken order initiates different camera functions such as focal-length selection, focussing, tilting, panning and on/off control. The particular order for the function to be performed can be spoken direct into a microphone without any manual manipulation.

The speech input system by which the camera is controlled is capable of learning, i e it notes the orders given to it. It also notes and stores the voice pattern and characteristics of the speaker. The individual commands such as on, off, right, focus, stop etc must first be spoken three times in succession in the same sequence and are thereby stored. Execution of the orders is first defined for the software so that they can be carried out appropriately.

After the orders have been input, the unit is ready for operation; it then identifies the orders and performs them. They can be cancelled at any time and input again by another speaker in the way described above The number of words that can be stored depends on the memory capacity Homonyms must be avoided.

The system can be used to advantage wherever operators have to keep their hands free The voice-controlled system can also be used to facilitate other types of work, for example, that performed by handicapped persons

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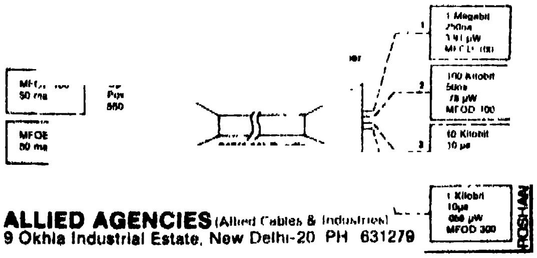

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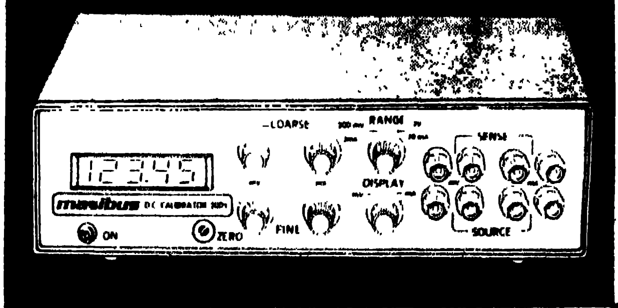

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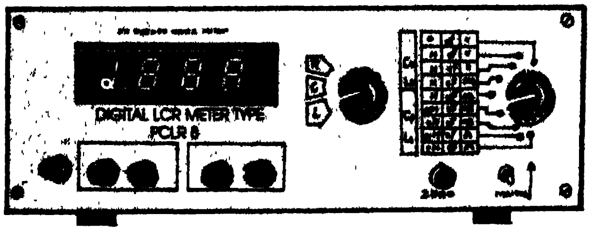

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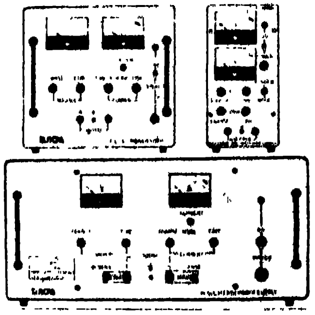

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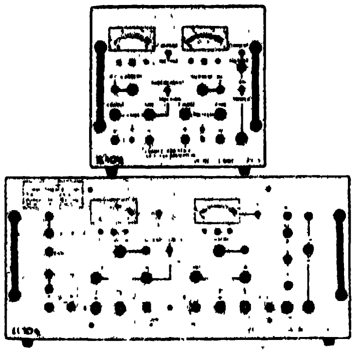

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Line & Load Regulation ±0 05%

Ripple 1 0mV rms max

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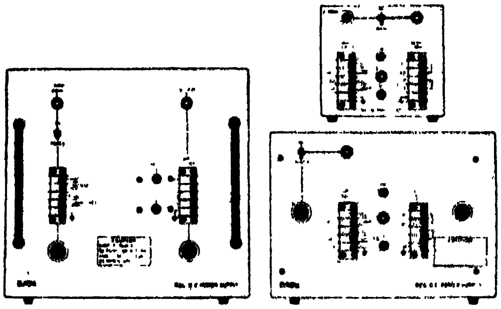

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Comparative Study of Computer Languages

Computer Organisation and Evolution of Computer Languages

Part III

R. Ramaswamy

A computer does not have only the single function of computation but also several other functions like reading the data and the program, storing them, doing arithmetic as per the program, outputting the result in a printed form in the desired format and so on. Each of these functions are done by separate functional units, but all of them act in coordination under a common control. Thus, it is said that a computer is a huge system composed of several related functional units which act under a common control to achieve a common objective.

A system is a composite entity made of interrelated elementary units or sub-systems which jointly perform a task under the direction of a single control. The human being is also a system, composed of different functional units acting under a single control –the brain. In short, a system is a composite entity whose constituents work together to achieve a common goal. The constituents of a computer also act together under a common control to accomplish the common job of data processing and so we say that the computer is a system.

Computer organisation

Computer is a system composed of different functional units for performing different jobs. It consists of the following major functional units:

1. Input unit,
2. Memory unit,
3. Arithmetic logic unit,
4. Output unit, and
5. Control unit.

The function of the input unit is to read the data and the program while the memory unit stores the data, the program and the result. The function of the arithmetic logic unit is to do the necessary computation as per the program of instructions and the output unit prints the result in a useful form.

There must be somebody to control the activities of these functional units. Just as the brain controls the functioning of the different human organs, the control unit controls the functions of the other units of the computer. The different functional units and their interrelationship is schematically represented in Fig. 6.

The thick lines indicate the flow of data, whereas the dotted lines denote the flow of control information. One can notice that the control pervades through all the functional units, whereas the data flows between specific units only. As far as the user is concerned, each functional unit is a black box, i.e. one need not know what these functional units are made of and how they do their assigned job. Suffice it to know that the different functional units are made of elec-

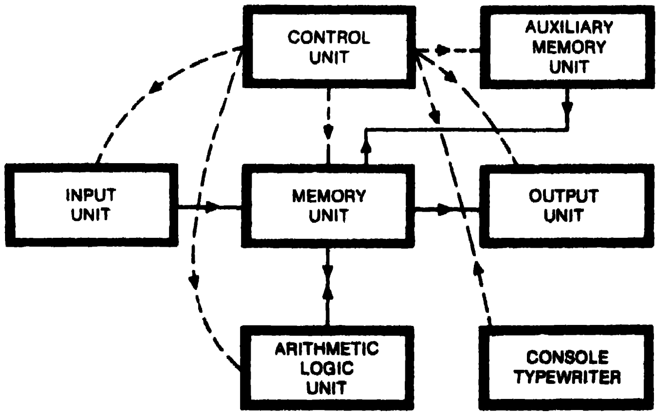

Fig. 6: Schematic representation of the functional units in a computer.

tronic components which are capable of doing the above functions quickly, accurately, reliably and completely automatically.

In addition to the automatic control, there is also a manual control provided in the computer. This is known as the console. Messages can be communicated through the typewriter attached to the console called the console typewriter. The computer will respond to the queries of the operator by typing messages on the typewriter or by displaying on a television screen attached to the console. This is called the visual display unit (VDU).

The computer can do any processing on the data only if the program and the data reside on the main memory. For solving large problems with large volume of data, the computer requires large memory space. To provide memory space within the computer will be relatively costly and so the computers are provided with auxiliary memory which is located outside. Just as the humans use paper media as their auxiliary memory, computers use magnetic discs.

When the auxiliary memory is attached to the computer, the control unit takes charge of the auxiliary memory unit also and directs it to transfer information to the main memory and back, as and when required. The combination of the control unit, the memory unit and the arithmetic logic unit is called the central processor unit or the CPU.

Evolution of computer languages

The development of computer languages started with the discovery of the computer in 1948. The earliest computer language developed for the machine is called the machine language. A machine language program is a set of instructions written for implementation by the machine using only the two digits -- 1 and 0.

Every instruction or data is coded by a suitable combination of 1s and 0s. Just as a combination of dots and dashes is used to send messages by telegraph, a suitable combination of 1s and 0s is used to establish communication with the machines. So a machine language program consists of a coded string of 1s and 0s, each string code having some specific meaning for the computer.

The next development is the discovery of the assembly language, in which the binary codes are replaced by alphabetic codes. Though the alphabetic codes are somewhat more meaningful than number codes, they are difficult to learn, since they are not akin to spoken languages.

Then comes the discovery of high level languages which are more akin to spoken languages. FORTRAN, COBOL, BASIC, PL/1 and PASCAL fall in the category of high level languages. They are easy to learn, since they are very much akin to the spoken English language.

The ultimate aim of computer scientists is to make the computers understand the spoken languages, so that man will be relieved from the burden of learning a new language for the sake of establishing communication with the computers. Till then, man has to study these high level languages if at all he wants to communicate with the computer machines.

Machine language programs

We have said that a machine language program will appear as a coded string of numbers 1 and 0 in the binary notation. For example, a machine language program to instruct the computer to add two numbers stored in the locations I and J, and finally store the result in the location K may look somewhat as follows:

```
0001  1111  1000
0011  1110  1000
0111  1000  1100
```

It is obvious that the above string of 1s and 0s is completely unintelligible to the layman. Even for the well versed, it is a difficult job to remember the code correctly and write it without making any mistakes. What do these strings of binary digits mean?

Taking the first line, the string of first four digits '0001' may mean 'store'. The string of next four digits '1111' may mean 'the contents of the location I'. The string of the last four digits '1000' may mean 'a location called the accumulator'. Thus the combination of 12 binary digits in the first line may mean 'store the contents of I in the accumulator'.

The 12 digits in the second line may mean 'add the contents of J with the number stored in the accumulator and store the result in the accumulator'. The 12-digit string in the third line may mean, 'move the contents of the accumulator to the location K'.

It can be noticed that since the machine language program is a string of binary digits having no resemblance to any spoken language, checking the program becomes very difficult, if not impossible. Again different computers have different codes and so the programmer has to learn the codes for each machine, which is time consuming and laborious.

Another serious drawback with the machine language is that one must have a knowledge of the machine parts to write the program, i.e. the machine language is highly machine dependent, and so a programmer who does not know about the machine cannot write a good machine language program. No wonder that man's efforts were directed towards reducing this communication gap between the man and the machine and bringing the machines nearer to the common man.

Assembly language programs

It has been seen that in the machine language, number codes are used to identify the different memory locations, their contents and the different operations. In the assembly language, the number codes are replaced by mnemonic name codes, which are easier to remember and identify. For example, an assembly language program for the problem given in the last section may look somewhat as follows:

```
LDA I    (meaning load I in the accumulator)
ADD J    (meaning add the contents of J with the
          contents of the accumulator)
```

MVA K (meaning move the contents of the accumulator to the location J)

It can be seen from the above that there is one to one correspondence between the machine language and the assembly language codes. Assembly languages are simply modified machine languages, where the binary codes are replaced by alphabetic codes which are somewhat easier to identify. In other respects, the assembly languages also suffer from the same disadvantages as machine languages, i.e. the assembly languages are also highly machine dependent and learning them is also laborious and time consuming.

The machine languages and the assembly languages are called the low level languages. Efforts made in the direction of making the program more meaningful and compact culminated in the development of the so-called high level languages.

High level languages

High level languages are more akin to English. The formulae used for computation look almost like algebraic formulae and the instructions for doing the different operations also look almost like ordinary English. In addition, the instructions are macros, in that one high level language instruction may be equal to a large number of machine language instructions, thus making the program very compact. Some of the popular languages in current use are FORTRAN, COBOL, BASIC, PL/1 and PASCAL.

The vast gap between the machine or the assembly languages and the high level languages can be seen in the following versions of the high level language instructions for the problem given earlier:

K = I + J (FORTRAN version)
ADD I TO J GIVING K (COBOL version)
K = I + J (BASIC version)
K = I + J (PL/1 version)
K: = I + J (PASCAL version)

It can be seen that the above instructions, or statements as they are called, are more intelligible than any of the machine or the assembly language instructions. We also notice that one statement in a high level language is equivalent to three statements in the low level language. In fact, it can be many more. That is why, the high level languages are macros. Again high level languages are practically machine independent and a person who has not seen a machine and does not know the machine parts can still write a good program following the rules of the language.

Whatever the high level language in which the humans write the programs for the problems, the computer will understand only the machine language. So the high level language programs have to be translated into the machine language. This is done by a special program called the compiler.

Compiler programs are used to translate the high level language programs to machine language programs. The high level language programs are called the source programs. The machine language program is called the object program.

The compiler programs check the grammar of the source program before translating the same to object programs. Any grammatical or syntax error in the source program will be pointed out immediately by the compiler program. Only if the source program is grammatically correct, the compiler program will translate it to the object program.

Requirements of high level languages

Earlier it was mentioned that the ordinary spoken languages like English are not suitable for communication with the computers. It is because these languages do not have unambiguous meanings for a particular set of words. Computers being machines cannot distinguish ambiguities in meanings. The computer requires to be exactly told in an unambiguous language as to what is to be done. One set of words must mean only one thing. Hence, any computer language must satisfy the following requirements:

1. The language must be context free.
2. The language must be unambiguous.
3. The language must be both semantically and syntactically exact.

Consider the following statements in English:

1. He is sitting under the table.
2. He is using a logarithm table.

The meaning of the word 'table' in the above two statements depends on the context. Such context dependence is not suitable for computer languages and that is the reason why the spoken languages are unsuitable for computers. Only one meaning can be ascribed to a structure or a string of characters in a computer language.

Let us now look at the following statement: 'They are flying kites'. This may mean that some people referred to by 'they' are flying kites. In another sense, 'they' refer to flying kites which are some sort of insects. Thus, it can be said that the language is grammatically or syntactically ambiguous, since the same pronoun 'they' refer to two different things. We say that the grammar or the syntax is not unambiguous, but the computer cannot distinguish such syntactical unambiguities.

Let us now consider the following statement. 'The table is eating the chair'. The sentence is grammatically correct, but its meaning is absurd, i.e. the semantics or the meaning is illogical. Computer languages must be both syntactically exact and semantically logical.

The development of computer languages requires lot of skill and ingenuity together with a knowledge of the anatomy of the computer. The high level languages have been so ingenuously developed that man does not see the machine at all when he learns the language but only sees the grammar. In other words, the grammar of the computer language makes the computer transparent to man. Thus we say that the high level computer languages are machine independent. It is this single feature that makes the learning of high level computer languages easy for all.

Computer languages and microcomputers

With the advent of a large number of microcomputers in the market, the different manufacturers have made some changes in the standard rules originally prescribed for the different languages. This has resulted in the appearance of different versions for the same language. Fortunately, the variations are only minor in nature and the readers can refer to the minor changes by referring to the manual of that particular computer. When one becomes a computer professional, one must refer only to manuals. The programming lessons and other programming books must be consulted only for learning the general philosophy of computer languages.

In this serial, the character sets in the different languages are introduced first, followed by the rules for coding the constants or the different data types dealt with by the different languages, the rules for coding the variables or identifiers and special words if any in the different languages, facts about variables and constants in the different computer languages, the rules for coding arithmetical, relational and logical operators and forming expressions in different languages.

It has already been pointed out that statements in computer languages give complete meaning to the computer just like sentences give complete meaning to the humans in spoken languages. So, the rules for coding different statements for doing different jobs are dealt with next.

Just as a plot or a theme is required for writing stories, in a similar way algorithms are required to write programs. The development of algorithms for different problems are also described.

A computer program operates on data. Data has to be properly arranged and organised for easy access by the computer. It can be kept independent and grouped into arrays or records. Different applications require different types of groupings. We have to study how the different languages support the different data groupings or data structures as they are called.

Finally, we have to study complete programs for different types of problems (scientific and business) in the different languages.

Let us first study the character sets used in the different computer languages.

FORTRAN characters

The first thing to do before starting the study of any language is to learn the characters used in that language. There are three types of characters in every language, namely, the alphabetic, numeric and special. The following are the different types of characters used in FORTRAN for coding the various entities:

Alphabetic: A B C D E F G H I J K L M N
O P Q R S T U V W X Y Z (26)
Numeric: 0 1 2 3 4 5 6 7 8 9 (10)
Special: + plus
- minus
slash (division symbol)
* asterisk (multiplication symbol)
- equality sign (assignment operator symbol)
decimal point
, comma
(opening bracket
) closing bracket
' quote mark
$ dollar sign (11)

In all, there are 26 + 10 + 11, i.e. 47 characters used in FORTRAN. Since we are already familiar with these characters, learning the character set in FORTRAN does not give rise to any problem.

COBOL characters

The following are the characters used in COBOL for coding purposes.

Alphabetic: A B C D E F G H I J K L M N
O P Q R S T U V W X Y Z (26)
Numeric: 0 1 2 3 4 5 6 7 8 9 (10)
Special: + plus
- minus or hyphen symbol
slash (division symbol)
* asterisk (multiplication symbol)
equality sign (assignment operator symbol)
greater than
less than
period or decimal point
, comma
semicolon
quote mark
(opening bracket
) closing bracket
$ dollar sign
blank (15)

There are 26 + 10 + 15, i.e. 51 characters in all used for coding purposes in COBOL. Since the character set is taken from English alphabets, Arabic numerals and the symbols used in conventional algebra, there is no special difficulty in learning the scripts of COBOL.

BASIC characters

Alphabetic: A B C D E G I J K L M
O P Q R W X Y Z (26)
Numeric: 0 1 2 3 8 9 (10)
Special: + plus
minus
slash (division symbol)
* asterisk (multiplication symbol)
∧ exponentiation operator symbol
- equality sign (assignment operator)
. decimal point
, comma
; semicolon
colon
" quote mark
(opening bracket
) closing bracket
> greater than
< less than
? question mark
% percentage
# hash symbol
$ dollar sign
\ backslash (20)

Here, the total number of characters are 26 + 10 + 20, i.e. 56 characters used for coding purposes in BASIC. As in other computer languages, these characters are familiar ones and so do not present any difficulty in learning them.

PL/1 characters

The following are the characters used in PL/1 for coding purposes:

Alphabetic: A B C D E F G H I J K L M N
O P Q R S T U V W X Y Z (26)
Numeric: 0 1 2 3 4 5 6 7 8 9 (10)
Special: + plus
- minus
slash (division symbol)
* asterisk (multiplication symbol)
= equality sign (assignment operator symbol)
break or underscore character
(opening bracket
) closing bracket
decimal point
, comma
; semicolon
colon
' quote mark
$ dollar sign
> greater than
< less than
& AND operator symbol
~ NOT operator symbol
| OR operator symbol
% percent
? question mark (21)

In all there are 26 + 10 + 21, i.e. 57 characters used in PL/1 for coding purposes. The symbol ∧ is alternatively used for NOT operator. The symbols \ and | are alternatively used for AND operator. So, total number of characters come to 60. Since these characters are familiar ones, no further explanation is required.

PASCAL characters

The following is the character set used in PASCAL for coding purposes.

Alphabetic: A B C D E F G H I J K L M
O P Q R S T U V W X Y Z (26)
Numeric: 0 1 2 3 4 5 6 7 8 9 (10)
Special: + plus
- minus
/ slash (division symbol)
* asterisk (multiplication symbol)
= equality symbol
:= assignment operator
. decimal point
, comma
; semicolon
: colon
' quote mark
(opening bracket
) closing bracket
[opening square bracket
] closing square bracket
> greater than
< less than
↑ pointer (18)

Totally, there are 26 + 10 + 18, i.e. 54 characters used in PASCAL for coding purposes. All these characters are familiar ones as in other computer languages.

Blank character

Blank is treated as character only in COBOL. In other languages blank is not strictly treated as a character. But blanks have to be given wherever the grammer rules demand.

While writing, the blank may be indicated by putting the small case letter 'b'. While communicating with the computer the space bar is simply pressed once. For alphabetic characters some computers will also accept small case letters. But for the sake of uniformity we will use only capital letters for coding purposes.

Summary

In this article, the evolution of computer languages leading to the development of high level languages has been discussed. Every language has a character set and a grammer. So also are all computer languages. The character sets used in FORTRAN, COBOL, BASIC, PL/1 and PASCAL have also been described.

It has already been pointed out that the rules of the computer languages have become slightly implementor dependent. So some of the characters given in this article may not be available in all machines and there may also be some slight modifications for the symbols. One must always refer to the manual of the particular machine for the exact list of character set.

(To be continued)

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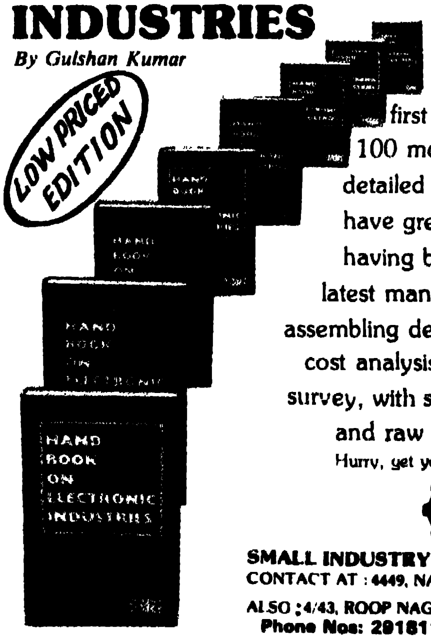

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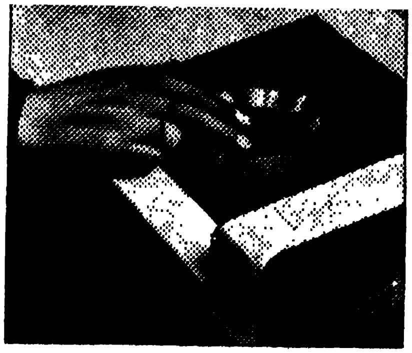

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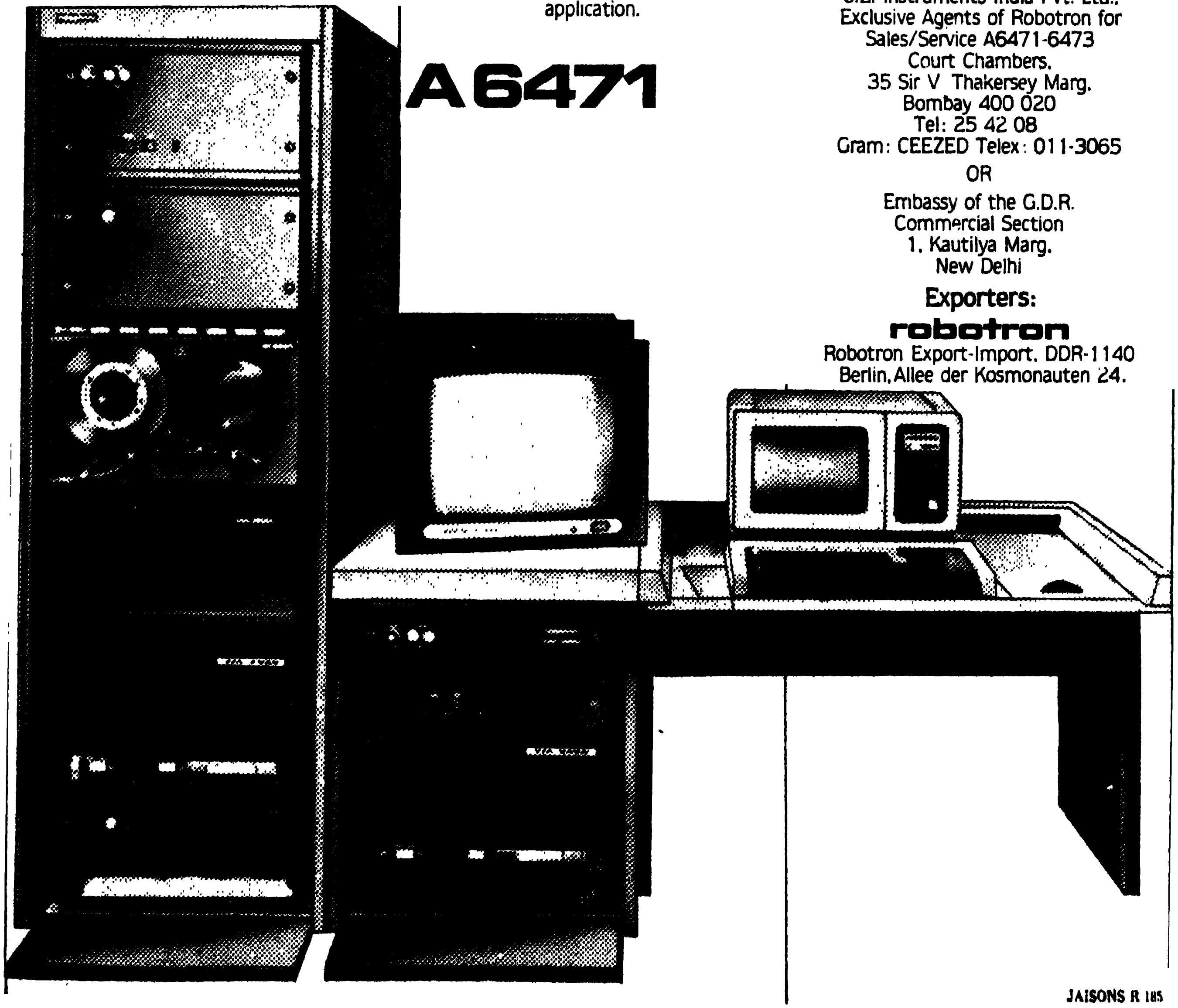

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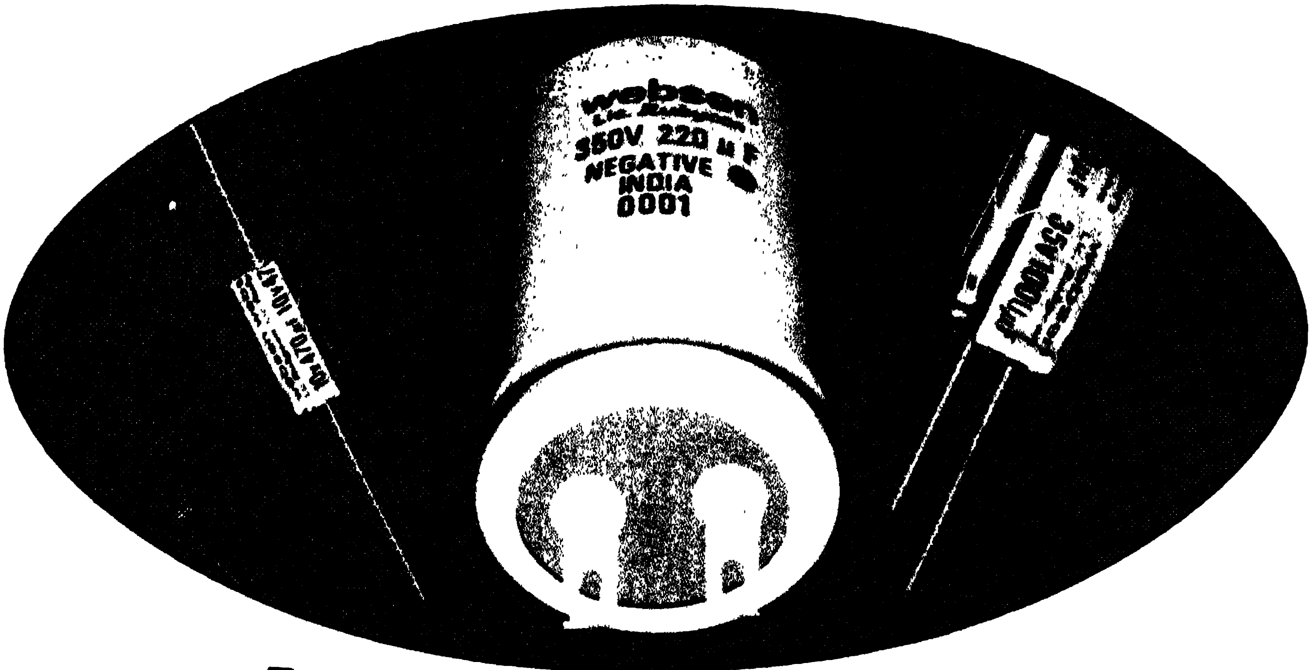

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Organising an Electronic Unit for Mass Production

Part II

C. Mohan

Different types of test equipments are required at various stages in an MPU. Let us discuss about them in detail.

Bare-board testers

Bare-board PCBs are those without components. Inspectors at PCB manufacturing units look for shorts and opens with a magnifying glass before they are despatched. Yet some shorts and a few opens may escape their eyes to give problems in the assembly. It is better to detect these before these boards are assembled.

Generally, a self-learn program generator is incorporated in these testers. So the first step is to keep a typical defectless bare board on the fixture and allow the tester to generate its own program. Then, the tester is ready for mass testing.

In-circuit and functional testers

In-circuit testers, in general, receive PCBs on a bed-of-nails fixture. Each component is sequentially connected to the tester which inspects for parametric values, placement etc. This way, one can find out shorts, opens, faulty mounting of components and faulty parts.

Functional testers, usually receive PCBs with edge connectors. They emulate the actual environment of the PCBs under test and verify their dynamic performance.

The lines between the in-circuit and functional methods have been somewhat blurred because in-circuit testing is actually a technique of isolation and functional testing. By isolation we mean that the device under test is removed from the effects of interaction with other components, including feedback and power supply of the PCB. Thus the device now is a passive component on which the tester can conduct its library of tests.

Table I shows the comparison between in-circuit and functional testers.

Some PCBs passing out of in-circuit tester may fail in functional tester. This may be due to the fact that some devices on the PCBs might be of the wrong specification or slow in speed. These factors are sometimes important to get the ultimate desired function.

In an MPU, it is not necessary that we should test PCBs with in-circuit testers first and only then with functional testers. PCBs, after assembly, can be straightaway sent to functional testers. Whatever boards pass out of functional testers can be sent to final assembly and unit test. Boards not passing functional test may be sent to in-circuit tester for detailed fault diagnosis. But this procedure may sometimes

TABLE I
Comparison between In-circuit and Functional Testers

Characteristics	Functional Tester	In-circuit Tester
PCB assembly test	Performance verification	Manufacturing verification
Fault detection	Leads to engineering and manufacturing analysis	Leads to manufacturing analysis only
Fault finding	Done at nodal level	Done at component level
Go/no-go test time	Fast	Slow
Fault diagnosis time	Slow	Fast
Timing sensitivity	Critical	Non-critical

cause costly mistakes because if a few PCBs with some circuit shorts are tested functionally, omitting in-circuit testing, it may lead to total failure of the PCBs. Hence, PCBs after assembly should be inspected for shorts and opens before feeding them into functional testers.

Some manufacturers of automatic test equipments (ATEs) combine both in-circuit testing and functional testing methods and produce a single system which is becoming popular in recent times. In some cases, it is a necessity. For example, a microprocessor can only be tested in-circuit on a functional level.

Let us now see a few types of test systems available.

System 1. A hybrid in-circuit tester 30/330S from Fairchild provides 639 hybrid test points. It performs testing for shorts and opens of analogue components and SSI, MSI and LSI digital components.

An automatic test program generator, an LSI test compiler and a debugger for easy modification of device routines earmarked for special testing requirements are included in the tester. It includes a minicomputer with 256k bytes of main memory, a disc drive, a programmer's keyboard and display, an operator's console with a printer, and a test-fixture receiver.

System 2. A combined in-circuit and functional tester made by Computer Automation can be used to test PCBs containing LSI, VLSI and microprocessors. 32k words memory, floppy disc drive and display unit are included.

A comprehensive software package that includes computer guided fault isolation (GFI), fault detection verification (FDV) and automatic fault isolation (AFI) is also available.

The emulation-simulation option can be used to generate user's own test programs. The analogue option is required to test analogue and hybrid PCBs. High-speed clip option permits faster and more accurate testing of sensitive and high-speed PCBs by minimising cross-talk and loading. Advanced fault resolution (AFR) option isolates and identifies any faulty component by part number and location. Real-time option permits high-speed testing of microprocessor and LSI-based boards.

System 3. Fairchild's in-circuit tester, Model 4400 can take care of 4000 test points. Its high-speed test sequence isolates and identifies shorts and opens in seconds. The tester can learn all typical parametric values easily, though the very first board should be typical and error-free. The tester learns about the PCB itself by 'self-learn program'. There is a pincheck software to verify good contact between fixture pins and PCB nodes. This tester can be used to inspect bare boards also.

System 4. A functional tester for performance verification tests boards for component to component interaction and isolates dynamic failures. Its automatic live data compression option can handle LSIs and VLSIs at full speed. Flo-tracer option isolates faults to the component level at high speed.

When selecting in-circuit and functional testers in addition to the specific needs of a particular unit, the following points should also be considered:

1. Today's PCBs are larger and denser. For achieving greater productivity, the testing speed should be more.
2. 'Self-learn program' facility is a necessity. Program generation speed should be more.
3. Technical knowledge required with the operator should be of low level.
4. The testing system should not demand that analogue and digital circuits should be on separate boards. It is a fact that modern packaging advantages do not allow this separation.
5. Production yield and test yield should be studied.
6 Will the system test complete spectrum the testing personnel normally come across? A satisfactory answer to this question is a must.
7. Expandability and adaptability are yet other points deserving study.

Signature analyser

Signature analysis technique was evolved to help component level troubleshooting. A signature analyser detects and displays the unique digital signatures associated with the data at the nodes in a PCB under test. By comparing these actual signatures to correct ones, a troubleshooter can quickly backtrace to a faulty node.

Whenever a designer makes a relatively complex digital equipment, it is his or her responsibility to add signature analysis capability into the equipment. Then a signature analyser in the production line can troubleshoot PCBs quickly and make mass production of complex digital equipments possible.

Signature analysis capability facilitates customer support since one will be able to provide a quicker field service. Signature analysis stimulus can be given to a product in two ways. It is either by adding some test features to the product itself in the design stage or by providing an external stimulus. By the first method, the designer includes guided-probe capability.

Signature analysers can be of manual or automatic type. In the manual type, signature tables and procedures for backtracing faults are given in the handbook. The manual unit displays the signatures only. It will not prompt the technician while backtracing faults.

An automatic signature analysis system (SAS) made by Hewlett Packard, HP55005A, consists of a programmable signature multimeter, a desktop computer and the software to knit the two together. The production engineer has to establish an electronic database for the MPU product into the SAS.

It contains a listing of ICs and pin number for the entire product, along with a network listing of the intercorrections among those pins and all their associated signatures. To establish the database, the production engineer selects the learn mode from the main menu of the troubleshooting program and through it enters the stimulus description, instrument setup, collect, verification, and verify-and-revise modes. In the stimulus description mode, the user simply enters a two line prompt to tell the technician which stimulus routine to use.

In the instrument setup mode, the basic troubleshooting system configuration is described by selecting from a menu. From the choices available, the engineer selects the polarities of the start, stop and clock signals as well as the appropriate threshold voltage levels for the data-high, data-low, clock, start, stop and qualifier signals.

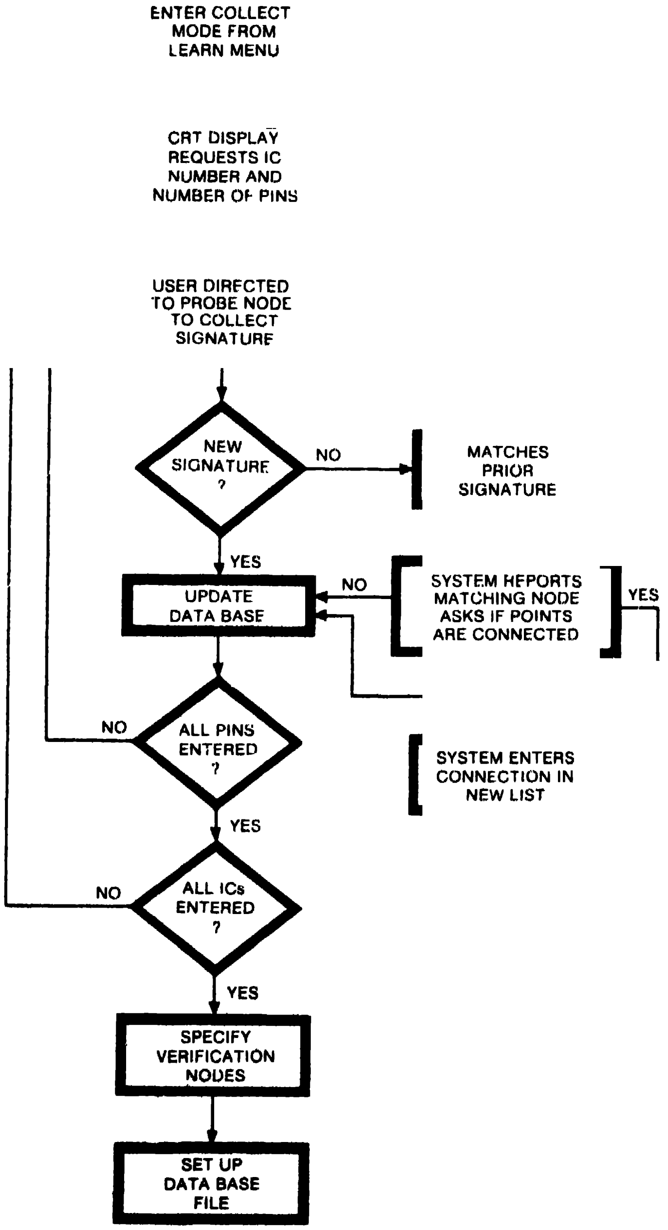
ENTER COLLECT MODE FROM LEARN MENU
CRT DISPLAY REQUESTS IC NUMBER AND NUMBER OF PINS
USER DIRECTED TO PROBE NODE TO COLLECT SIGNATURE
NEW SIGNATURE ?
NO
MATCHES PRIOR SIGNATURE
YES
UPDATE DATA BASE
NO
SYSTEM REPORTS MATCHING NODE ASKS IF POINTS ARE CONNECTED
YES
NO
ALL PINS ENTERED ?
SYSTEM ENTERS CONNECTION IN NEW LIST
YES
NO
ALL ICs ENTERED ?
YES
SPECIFY VERIFICATION NODES
SET UP DATA BASE FILE

Fig. 10: Preparing database for SAS collection mode.

In the collect mode shown in Fig. 10, the number of pins on that device are specified. As each pin is entered, it is designated as an input, output, power supply, or ground pin. At that point, the actual measurement of signatures on the product begins.

A signature is taken for the pin and automatically entered into the database. If that signature matches one already stored in the database, the software asks if that pin is connected to the pin with the matching signature. If the answer is yes, then the connection is automatically entered into the circuit topology description. The repetition of this process builds up an entire description of the circuit topology as well as the measurement of a signature for each mode in the product.

When the collection process is complete, the engineer enters the set of critical verification nodes which often indicate the status of an entire section of circuitry, such as input/output pins, data or address buses. Once the circuit database exists, reprobing the product is done in the verify mode to ensure that the signatures at the circuit nodes correspond to those in the database.

Whenever the product under test is changed, the corresponding database may be edited in the revise mode, which lets a part of the database to be revised without having to recreate the entire base. Full editing capabilities are also available during the initial establishment of the database in the other modes.

Database can be created for a number of PCBs or products by storing the nodal maps on a diskette or tape car-

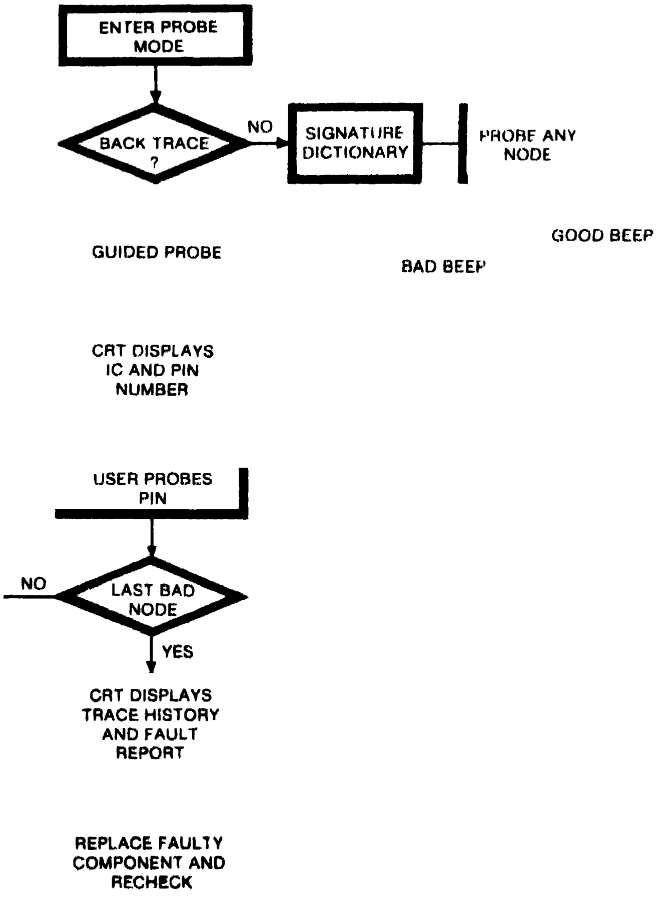

Fig. 11: SAS probing faults.

tridge. This way, there is no need for maintaining separate device libraries in SAS; the SAS creates its own signature dictionary once a nodal map is entered.

Now, let us see how to use the SAS to troubleshoot a board for which a database has been entered earlier (Fig. 11). The user will have two modes to choose from: the signature dictionary and the backtrace modes. In the signature dictionary mode, the SAS generates two types of beeps a good beep for the correct signature and a bad beep for incorrect signature. Hence, the user need not see the CRT display in SAS at all.

If the operator comes across a bad signature, he selects the backtrace mode of the SAS to trace the faulty component. In this mode, the user is prompted with the help of the CRT display to probe a set of points in sequence, tracing a trail of bad signatures back to the bad circuit node.

The user can also choose the backtrace mode directly. The SAS will first direct to probe the critical verification nodes. When a signature is found, the backtrace algorithm searches the database for those points that influence the node containing that signature. It then directs the user to probe those points by displaying the IC and pin numbers of the points to be probed on the computer's CRT. If all the input points affecting an output have good signatures while the output itself has a bad signature, then the user has found the faulty node.

In an MPU, one will not have time to look up signature tables and decide about backtrace steps. Also, human error will creep in if the signature on the display is misread. These two facts associated with manual signal analyser, influence the manufacturing manager to add an automatic signature analyser in the production line. Signature analyser is thus very useful in an MPU producing microprocessor-based equipments.

Data acquisition systems

A modern data acquisition system would make a series of events take place, make measurements that can ensure certain qualities in those events, control certain other events according to the results including alarms, keep a record of happenings, and periodically report to a central database.

A data acquisition system is a computer-based system which can measure outputs of thermocouples, flowmeters, strain gauges and similar transducers. It has digital inputs and outputs. D/A converters are necessarily available. Measurement speed of 4500 channels per second is possible. Measurement and display resolution of 6½ digits is available. The desktop computer attached automates the system, stores data, linearises transducers, and provides computational and analysis facilities. A 20-channel reed relay assembly provides low level guarded switching. High-speed scanning of 4500 channels is achieved with FET assemblies. A non-volatile real time clock is available to time the system. Softwares like operational verification programs, system sub-programming routines and typical application programs are provided.

It is not necessary that a computer should be exclusively connected to a data acquisition system. A computer already in use for operations like inventory control can become the host for a data acquisition system.

A sequential events recorder can be incorporated as a part of data acquisition system. One of the sequential events recorder available today has 128 channels recording the occurrence of digital events like contact openings and closures to within 1 ms. A software option tells the equipment to print a listing of events prior to a program listing trigger event, and then to continue listing backlogged events following the trigger. Another option is to present colour-coded, 64-character single-event descriptions, at 20 events per frame, on a multicolour CRT display.

Sometimes it is necessary to have a dedicated data acquisition system situated very close to the processes to be controlled. This is the case with processes with severe environments where degradation in signal quality can be expected if it is taken to a host computer which is far off.

Nowadays, single board microprocessor-based data acquisition systems are available. For example, a commercially available system with a 8085A microprocessor, 6k bytes of ROM and 1k byte of RAM provides input protection and isolation, cold junction compensation for thermocouples, sensor linearisation and scaling. It checks alarm limits and senses contact closures. A variety of measurements can be made.

Burn-in tester

Nowadays, most of the equipments or PCBs are burnt at an elevated temperature for a number of hours which can vary from simple 1 hour to 96 hours. The equipments or PCBs are kept operating at a temperature which is much more than the normal working one. Due to this, all devices will be required to operate at their extreme specification limits and any failure at this stage would amount to avoiding a potential field failure. In case such a tester is used in MPU, it has to be automated.

A typical tester carries a Z80 microprocessor-based controller. There is a keypad and 24-digit display with which the operators can set various burn-in cycle programs and check the status of the equipment in the burn-in chambers. If the tester is connected to a host computer, burn-in cycles can be set and monitored from a central location. The host is capable of downloading such instructions to the controller memory as the sequence of on-off states for power supplies, temperature settings and the duration of burn-in.

The burn-in cycle can be divided into ten different phases with variables being redefined for each phase. In addition to logging burn-in events, the host computer keeps up with the use of individual burn-in boards by means of serial numbers and protects the user from the use of faulty boards. Also, it has got a 5-hour battery backup to save burn-in programs in RAM chips during power failures.

Tester for backplane wiring, harness assemblies and cables

A typical tester will allow a backplane with about 2000 points to be tested in seconds. Typical speed is 500 test points/sec. The tester is microprocessor-controlled and entries are through a keypad. To start with, a correct backplane, harness assembly or cable is connected. Equipment is switched to self-learn mode. Once the equipment has programmed itself, it is ready for mass testing. Test sequence can be edited. A 14-character display is available. Apart from internal memory, provision for cassette memory is also made. There is a 20-column thermal printer attached to automatically print out errors.

This tester is ideal for an MPU producing equipments with complex wired assemblies.

Discrete component tester

A computer-controlled unit to test all common discrete components bipolars, diodes, switching diodes, rectifiers, darlingtons, FETs, SCRs, triacs, diacs, optocouplers is available. Dual floppy disc storage with optional cassette backup is provided.

Programmable controller

As defined by the National Electrical Manufacturers Association, a programmable controller is a digital electronic apparatus with a programmable memory for storing instructions that implement specific functions such as logic, sequencing, timing, counting, and arithmetic to control machines and processes.

A programmable controller is broken down into five major sections, each of which may reside at different physical locations or together under one housing: the CPU, program memory, I/O modules, power supply and programming device. The CPU scans the I/O modules to determine the status of the switches and values that the modules control as well as the program memory to receive instructions. It then generates appropriate control commands to the output devices on the I/O modules. Process or machine-status information is continuously fed to the CPU via the I/O modules' input sections.

Common programming devices for the programmable controllers include CRT terminals, keyboards, and other manual programmers with keypads, and thumbwheel switches. The switches employ alphanumeric displays that allow the programmer to follow program steps as they are entered into memory.

Available systems can now handle anywhere from 4 to more than 8000 points. Memories can range in size from 250 to over 1000k bytes, and words can be 8, 16, or 24 bits wide.

Clip-on DC milliammeters

One should be able to measure current faster without physically cutting a circuit line and inserting a current meter. For this purpose, clip-on ammeters are available which, with a transducer, convert the magnetic field around a conductor to AC voltage proportional to DC current. They are available with wide range, as much as 1 mA to 10 amp.

Digital displays

Instruments with digital display offer the following advantages compared to their analogue counterparts:

1. Results are read faster.
2. Readings are accurate and less ambiguous.
3. Good resolution is possible.
4. Operator fatigue is virtually avoided to make minimum errors.
5. Readings can be noted from a distance.

In an MPU, usage of digital display equipments will definitely give better results.

Digital multimeter

Usually, all the digital multimeters available have auto-range, auto-zero and auto-polarity capabilities. With auto-range, one can avoid the need to change the range multiplier and auto-zero eliminates the need to zero the multimeter prior to measurement. Without the inconvenience of reversing test leads, the operator can measure both positive and negative voltages, with the auto-polarity circuit included in the multimeter.

Multimeters which can dispiay 3½ digits to 6½ digits are available and can be chosen according to specific requirements.

Some manufacturers make multi-input multimeters which have a thermal printer also. By pushbutton selection, all parameters can be digitally measured, one by one. Printer gives out readings at will. It can automatically scan, measure and print any parameter at preset time intervals.

Digital LCR meter

This is used to measure inductance, capacitance, and resistance parameters of components.

The instruments available today do not require the operator to do any tedious balancing as in older instruments. They offer high accuracy (like 0.2%), both 120Hz and 1kHz measurement frequencies and high measurement speed (as high as 4 per second). Most instruments have autoranging capability.

Digital IC tester

One of the commonly available IC tester has the following facilities:

1. For testing any IC, first the corresponding program card given by the manufacturer should be inserted into the unit.
2. A single unit can test almost all IC families, i.e. ECL, CMOS, TTL, HTL and DTL. All logic gates, arithmetic logic ICs and ROMs can be tested.
3. The tester not only conducts functional tests on the ICs as per their respective truth tables, but also the DC paramet-

ric tests.

4. All tests are automatically done.

5. A printer prints out details regarding whether a program is loaded correctly and what program it is. Also, it records the number of failed and passed IC's and provides failure analysis information for each failed IC.

6. If program cards are not available for some special ICs, their testing can be programmed by the users.

Dedicated instruments

By dedicated instrument we mean an instrument which serves only one purpose continuously. This way, virtually no adjustments and settings are required to be done before the measurement. There is nothing called setting time with this kind of instruments. They contrast with multipurpose instruments. Although multipurpose instruments will in general be cost-effective, dedicated instruments will save a lot of time and labour compared to multipurpose instruments. This point must be considered when one plans to make or buy instruments for an MPU.

Also, all strategic equipments and machines should be made available in number and adequate spares should be stocked. That is to say that one should be able to put back a defective equipment into operation faster so that downtime will rarely become a significant factor.

Software for testers and production aids in MPU

Manufacturers of automatic test equipments and automatic assembly equipments generally supply software with different utility objectives. When buying such equipments two things should be kept in mind:

1. Present software requirement should be fully met by the equipment supplier.

2. Not a day passes without the introduction of at least one new device. The new devices find their way very quickly into new products. The test equipments are required to test these products also. Hence one should see whether software for these products can also be prepared without much difficulty and modification.

Frequent modification of software may end up in software costing more than hardware!

Device engineers are always trying to bring out chips which can do more functions and they accommodate stringent performance needs of equipment designers. The result is the birth of complex devices and for testing these, complex software is required. Since time available for preparing this software is limited, people have started resorting to computer-aided design (CAD) techniques for preparing it.

Most of the automatic test equipments employ a software called automatic test program generator which generates test vectors and supplies fault-detection and isolation data. A typical automatic test program generator is shown in Fig. 12.

The program generator has all major combinational logic devices like NAND, NOR, AND, inverter etc, and sequential logic devices like latches, flip-flops etc. ROM and RAM devices are listed as primitives of the system.

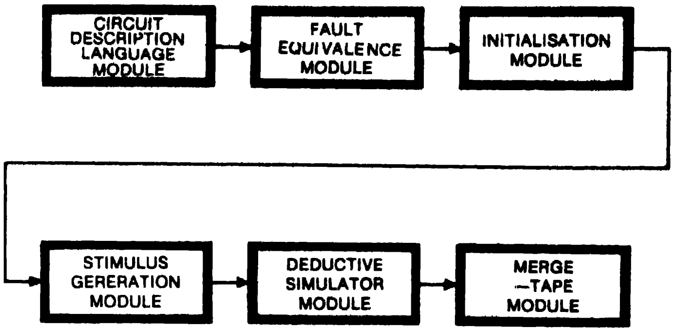
CIRCUIT DESCRIPTION LANGUAGE MODULE
FAULT EQUIVALENCE MODULE
INITIALISATION MODULE
STIMULUS GENERATION MODULE
DEDUCTIVE SIMULATOR MODULE
MERGE —TAPE MODULE

Fig. 12: Automatic test program generator.

The circuit description language module accepts the user's description of a circuit to be tested which is presented in the form of connections between ICs, listed as primitives. This module checks syntax to verify that the user has followed the system's language standards and then creates database topology tables for subsequent processing in the system.

The fault equivalence module identifies failures and organises them into fault equivalence classes. Each class comprises a group of failures whose responses are indistinguishable from one another; that is, their failed response is the same. Processing by equivalence classes rather than by individual failures significantly reduces computer storage requirements and speeds up failure handling. From this module come the digital topology and failure-universe data that are necessary to generate a test program. Successive modules employ that data to perform their functions.

The initialisation module, as the name indicates, generates appropriate input stimuli that place all sequential devices in a known state.

The stimulus generation module includes a path-selection and path-priming algorithm for simplifying subsequent failure propagation to an output pin. A functional set-up algorithm automatically generates tests for counters, shift registers etc. This program is the heart of the automatic test generation process itself, i.e. it contains a backtrace procedure that creates a test for the candidate failure, and a forward-trace process that propagates the failure to a primary output along a previously selected path.

The merge-tape module formats the test and isolation data and writes onto magnetic tape. Now the program generation is complete.

We can see that the software automatic test program generator can also be used for design verification and testability of a circuit prior to manufacturing it. The circuit description language module identifies errors in IC interconnections. The stimulus generator module provides patterns for inputs of devices and prompts an output response for these inputs for the designer to study.

(To be continued)

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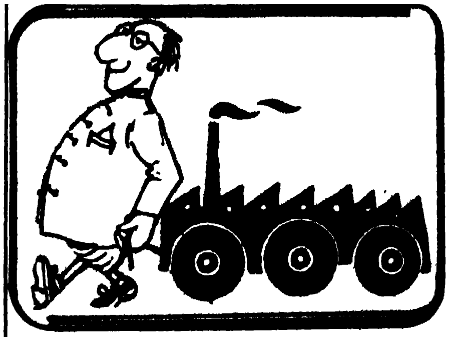

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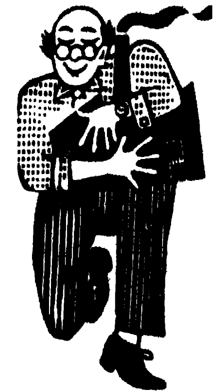
- Wire Wound Resistors



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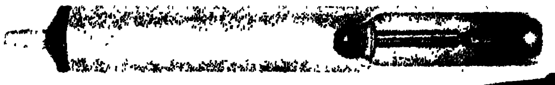

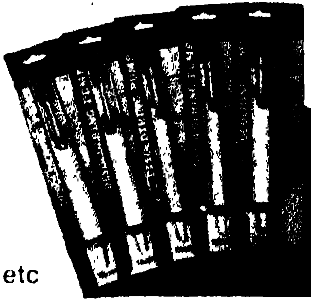

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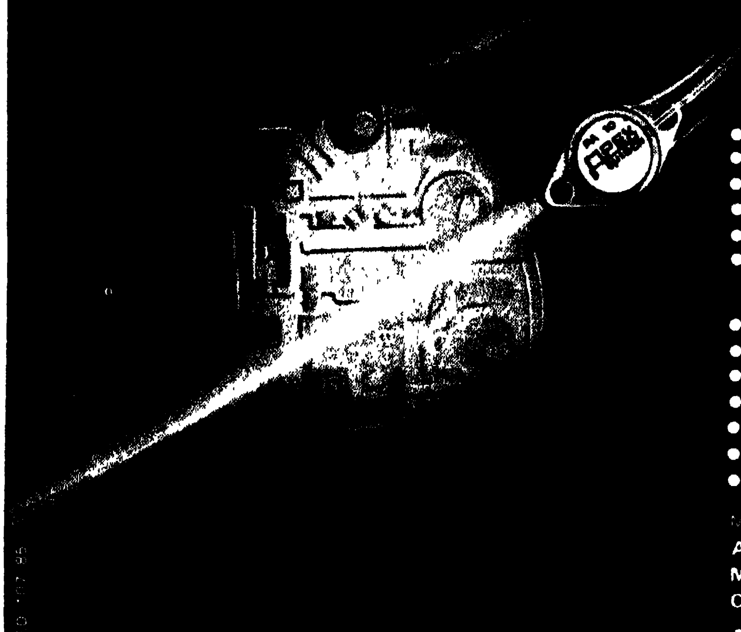

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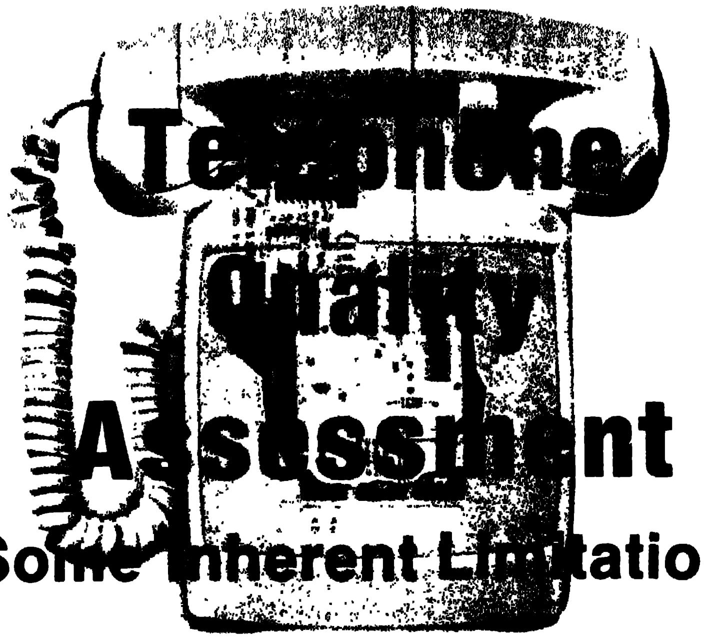


Telephone Quality Assessment

Some Inherent Limitations

B.L.K. Rao and T. Usmani

For a long time, transmission quality of telephones has been assessed on the basis of subjective comparisons between different telephones. Although this psycho-acoustic subjective method is close to real life practice, it has got various limitations which will be discussed later. The objective type electro-acoustic method of quality assessment also does not fulfil the high expectations of telephones users.

In fact, the expectations of telephone users with regard to quality have increased to a large extent today. Intelligibility and audibility of speech have now become the major factors of telephone quality. The real problem lies in the fact that they are purely subjective and totally independent of each other. Also, these parameters may vary from man to man depending upon personal liking, age group and climatic conditions etc.

In a recently published article, Mr Bernhard Rall of AEG Telefunken comments over the same problem: "Telephone user, while appreciating a good volume level, lack of distortion and a minimum of background noise, very rarely even holds the handset for optimum speech intelligibility. Apart from simple human factors, far more complicated technical factors affect speech quality characteristics such as sending, receiving, and side tone reference equivalents which are used to describe the telephone's essential properties. These are very expensive to measure and provide only an indication of mean loudness. Apart from this, simple electrical measurements like telephone input impedance show substantial differences between different types, depending on age, earphone type, manufacture and on the position of the handset when carbon microphones are used. Variation in transmission quality can also arise from the use of different telephone switching equipments, different cable lengths and dimensions, different transformer relay circuits, feeding, inductors" etc.

Test arrangements

Test arrangements may either be subjective or objective.

Subjective tests are those based on real life practices. Here, normal conversation is conducted between two parties without putting any artificial means in the system and the speech quality rated as good or bad by the persons involved. Such tests give the real picture of the system, termed as valid tests. Subjects can express their amount of satisfaction over speech quality, handset comfort, ease of dial operation, suitable loudness level etc which cannot be measured numerically.

Objective tests are tests performed in laboratory where artificial equipment arrangements are provided for electro-acoustical measurements. Here, artificial ear and artificial mouth are used alongwith various other test arrangements. These tests are simpler and quicker with high repeatability. They are best suited for regular quality evaluation as the numerical answers obtained form the easy basis of acceptance or rejection.

It is clear that subjective tests are more 'valid' tests since they are based on real life experiences. Their repeatability is low as different person's sensation of the same stimulus is quite different from each other. Hence, similar experiments with the same people may give different results at different times. On the other hand, the validity of an objective test may always be questioned as to whether the electro-acoustical test arrangements truly represent the real life practice or not.

To be more specific, recording the telephone receiver frequency response curve is invalid if the volume coupling of the receiver to the measuring microphone does not approximate the acoustic impedance of the human ear. In such a case, the receiver which was passed in the lab, may give bad results when put to actual use. Hence the tests which are devised under laboratory conditions should be firmly based on actual life experiences and the experimenter has to clear all the doubts in this regard.

While objective tests are artificial and results may be in terms of somewhat irrelevant quantities, subjective tests are imprecise and many important factors are largely unknown as well as uncontrollable. Thus, to adopt a balanced measurement procedure, the physical and other conditions in the field are first surveyed. Laboratory tests are then conducted under conditions shown to be relevant by the field survey. The final assessment is then made in the field using, as far as possible, the same assessment criteria as used in the laboratory. Both subjective and objective types of measurements are then made to arrive at a particular acceptable passing range for a particular characteristic. In fact both types of systems have got their own limitations, where a practical correction factor is to be evaluated for necessary correlation between each other.

The wide variety of characteristics for telephone connection to achieve fundamental information requires systematic planning of telephone network. It must always take into account factors including loss, circuit and room noise, various distortions, side tone, echo, propagation time, effects of various voice switching devices and finally the overall effects of all practical combinations.

THE TEST PIECE

Telephone instrument, the subscriber apparatus, has got its own various limiting factors for a perfect design. Handset dimensions, microphone and earphone characteristics, side tone balancing etc are the vital factors of interest in this regard.

Handset dimensions

The distance between the centre of the opening of ear canal which is taken as reference point of listening and the centre of the lips which defines the reference point of mouth is widely studied internationally over various human heads for the development of an ideal handset. One more problem is that the radiation pattern of a real mouth does not allow all the speech sounds to enter the mouthpiece of the handset while speaking. True reproduction of speech into electrical and back to acoustical form is also considerably difficult. Another serious complication arises due to the fact that different sounds are generated from different positions in the mouth which refers to variation in source position.

According to an expert, "the variability between the physical dimensions among the human heads including the fact that the female heads are not only smaller than male ones, but also yield less reproducible results, causes complication for the design of telephone handsets... An angle is also required to define the direction in which speech is emitted from the mouth into the mouthpiece of the microphone. This is very difficult to define precisely."

Carbon microphone

Carbon microphones which are used as acoustical to electrical energy converters have their own severe drawbacks. Perhaps it is the weakest link in the telephone network where a lot of precautions have to be taken for proper output response. Proper conditioning of the microphones before actual measurements is also very essential and has been described by the International Telegraph and Telephone Consultative Committee (CCITT) in the following manner:

"The CCITT considers that since the characteristics of carbon microphones are strongly dependent on conditioning techniques, it is necessary to follow a consistent procedure prior to measuring sensitivity/frequency characteristics

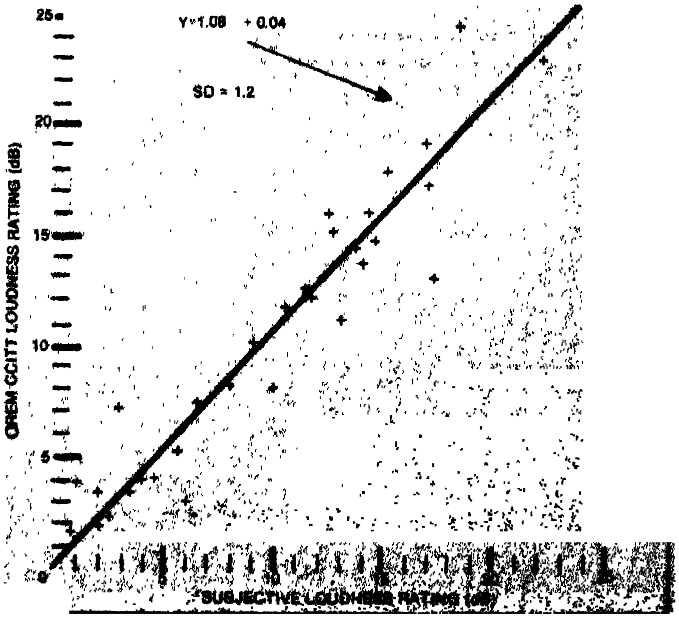


Fig. 1: Comparison of results using subjective and instrumental methods for determination of loudness ratings

in order to obtain reproducible results. The following steps are specified for the standard conditioning method:

1. Place the handset in a holding fixture with the handset clamped in a position corresponding to that in which the microphone is going to be measured.
2. Connect the microphone or telephone set terminals as required to the DC feed circuit and appropriate terminating load.
3. Turn the feed current on. After 5 seconds, condition the microphone by rotating it through an arc slowly and smoothly. The microphone face should reach a vertical plane during the initial part of the rotation. In this vertical plane, a reference vector should be visualised which passes through the centre of the microphone and points straight up. Rotation should be continued until this reference vector points straight down (i.e. movements of the reference vector through 180^0). The direction of rotation should then be reversed and the microphone returned to its starting position.

Without interrupting the DC current or jarring the microphones, repeat this process two more times. The speed of rotation is not critical but should be slow enough to ensure that the effect of centrifugal force on the carbon granules is negligible. Finally, return the handset to the measuring position."

The real voice sensitivity measurement of carbon microphone is very difficult. A voice test team at Standard Telecommunication Lab (STL) in England was set up to determine the sensitivity frequency characteristics of a wide range of telephone subsets. They noted that, "although it is just over one hundred years since the carbon microphone was invented, it is evident from a number of factors that we do not as yet know how to measure its performance adequately. For instance, if we compare subjective test results of loudness ratings with loudness rating calculations made from objective measurements of the sensitivity frequency characteristics of carbon microphones, large discrepancies exist which are not wholly accounted for by expected subjective test variability. Documentary evidence of these facts is quite clear in the results of the CCITT programme for the development of a new method for loudness rating of telephone sets."

Fig. 1. shows the results of some sound loudness rating determinations made subjectively and objectively in the telephone set evaluation laboratory at STL. Here it is plain that a few telephone sets appear to need special treatment, or perhaps different treatment, from others with respect to the determination of their sensitivity frequency characteristics for loudness rating calculations.

This team took speech repetition tests using various methods including real voice excitation tests. Sets of male voice as well as female voice were used. The final loudness rating calculations showed that about 2dB discrepancy exists in the determination of carbon microphone sensitivity comparison.

The sensitivity of carbon microphone is defined as follows:

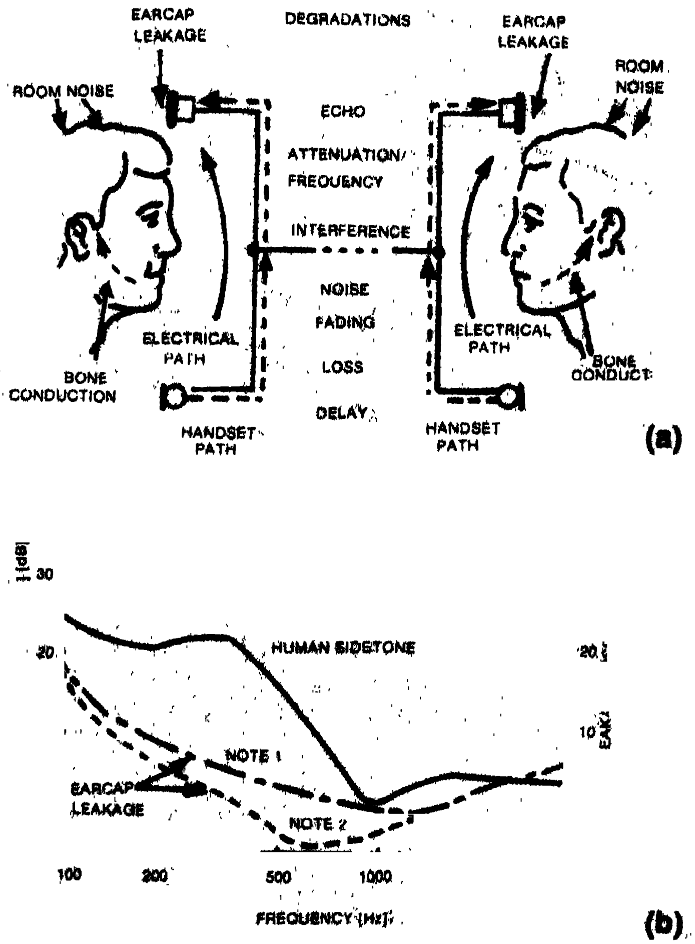
$$S_M = 20 \log_{10} \frac{\text{Open Circuit Output EMF}}{\text{Free Field Sound Pressure}}$$

at mouth reference point, limits being relative to 1V per N/m^2.

By expressing the sensitivity in this manner, the effects of differences in the lengths of handset will be appropriately reflected in the results under practical condition of service, considerable departure from so-called 'model' position will naturally occur and these will be accompanied by variations in vocal level.

Earphone characteristics

The sensitivity of the earphone represents the output acoustical energy with reference to the given electrical power. It is measured at the ear reference point by coupling a



NOTE 1: EARCAP LEAKAGE USED IN CALCULATION OF SIDETONE LOUDNESS RATING (STMR)
NOTE 2: EARCAP LEAKAGE UNDER STUDY BY THE CCITT AS BEING REPRESENTATIVE OF REAL TELEPHONE USE.

2(a): Sidetone paths. (b) Human sidetone loss and earcap loss/frequency characteristics.

suitable sound pressure measuring device designed to represent the acoustical load of human ear which is termed as artificial ear. Mathematically, sensitivity is expressed as

$$S_E = 20 \log_{1} \frac{\text{Output Sound Pressure in N/m}^2}{\text{Voltage Across Input Terminals}}$$

The unit being dB relatively to 1N/m² per volt. Here also the background noise as well as the artificial coupling of the ear piece with the human ear play an important role. A good sealing between earphone and ear, and proper shape of handset etc are also taken into account.

Side tone balancing

Side tone is the reproduction in a telephone receiver, of sounds picked up by the microphone of the same telephone sub-set. Side tone balance is satisfactory if the environmental or room noise picked up by the microphone, possibly including the speaker's own voice, are only heard at an attenuated level in the receiver. Inadequate side tone balance adversely affects conversation due to: (i) room noise at listener's end, and (ii) speaker induced into lowering his own voice. As there is increasing traffic over telephone sub-sets located in rooms with high ambient noise level, side tone balancing has become very important.

The CCITT-recommended STRE of about 9 dB using NOSFER, is not met in many cases. This is due to mismatching between the hybrid balancing network and the line impedance seen at the terminals of a telephone sub-set. Effective measures to improve the side tone balance can only be taken if the influence of the parameters of transmission path and telephone instrument is known. To this end, it is necessary to analyse the circuit characteristics of telephone sub-set, the type of cable used, and the impedance transparency of the trunk circuits of switching system, taking into consideration all devices connected to the transmission path.

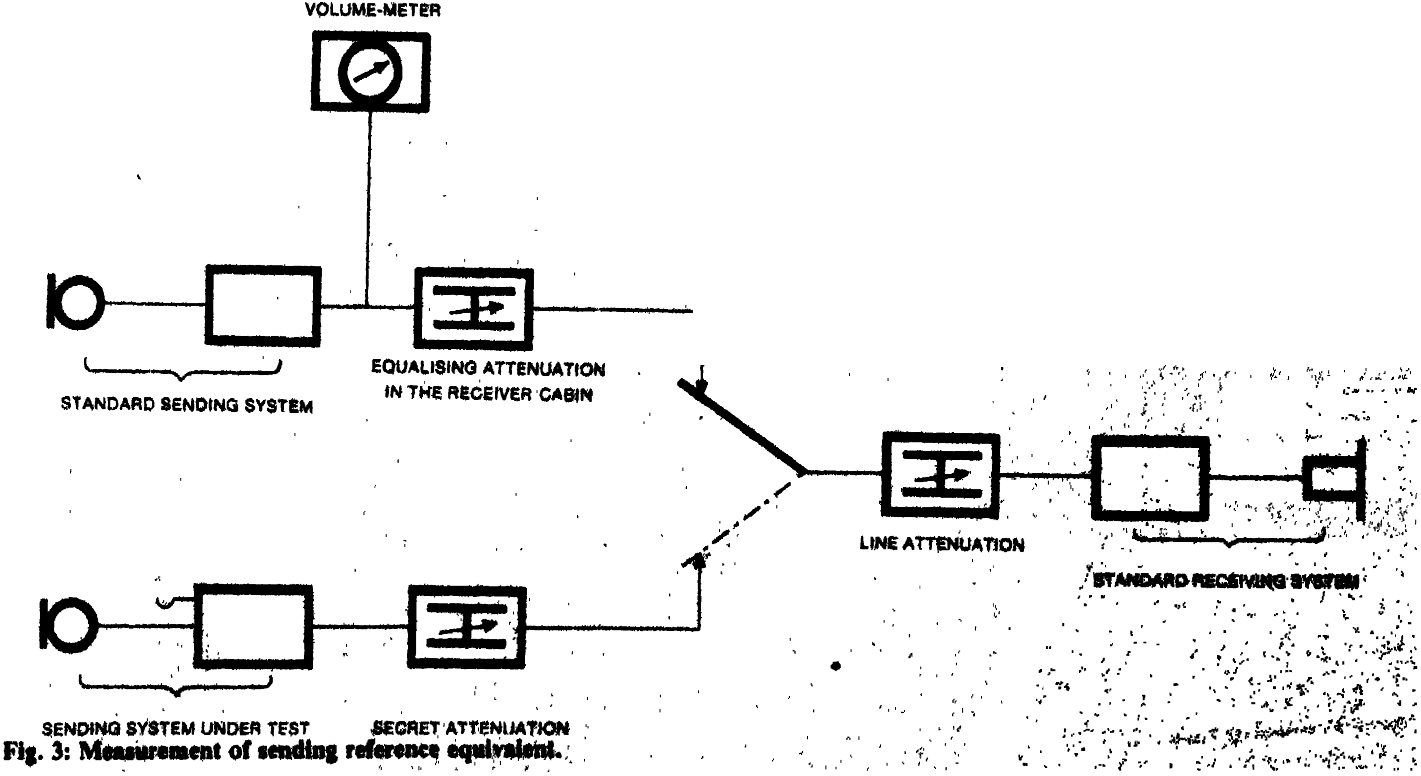
In fact, the transmission performance of a telephone connection varies as far as the customer is concerned, not only with the overall loss in the circuit but also with the amount of side tone present in the circuit. There are various types of side tones, controllable and uncontrollable, both of them having their own effects.

During a telephone conversation, the speech enters a talker's ear by three paths, electrical path through the telephone set, a bone conduction path and an earcap leakage path. Also, during the conversation, room noise enters the listener's ear via two paths, the electrical path and the earcap leakage path. These effects are known as talker's side tone (speech side tone) and listener's side tone (room noise side tone) respectively. In addition, there can be an acoustic path through the handset itself, resulting from imperfect sealing of transducers (Fig. 2).

TRANSMISSION QUALITY PARAMETERS

Perception of speech transmission quality is two dimensional and may be divided into two independent factors—intelligibility and naturalness. Intelligibility depends upon the loudness of speech signals while naturalness represents the individual characteristic of the speaker (identity etc).

Till today, no instrument is available for measurement of overall transmission quality. Different telephone administrations have adopted different methods, which basically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EQUALISING ATTENUATION IN THE RECEIVER CABIN
LINE ATTENUATION
STANDARD RECEIVING SYSTEM
SENDING SYSTEM UNDER TEST
SECRET ATTENUATION

Fig. 3: Measurement of sending reference equivalent.

depend upon subjective ratings. CCITT has also recommended a few of these methods and has tried to standardise them as much as possible. Some of these methods are described below.

Reference equivalent

This is the characteristic for the loudness of a telephone system, expressed in dB, indicating the extent by which the system under test is louder or less louder than the zero level determined in the reference system of new fundamental system for determination of reference equivalent (NOSFER) approved by CCITT.

Thus the reference equivalent is a relative loudness value measured by means of voice and ears with respect to NOSFER system. NOSFER is a set of equipments available in CCITT laboratories which comprises of the following:

1. The transmission path, sub-divisible into sending end, junction and receiving end.
2. A centralised apparatus for the supply of room noise and interconnection facilities.
3. A calibration equipment.

The comparison is direct if the NOSFER is used and indirect if a secondary system compared previously with NOSFER is used as standard.

The measuring set up for sending reference equivalent is shown in Fig. 3. One of the persons participating in the measurement reads the test text into the microphone of the system under test and into that of the standard system (NOSFER). Another person at the receiving end listens to the speaker and adjusts both systems to identical loudness by means of an attenuator box. Normally, a trained group of three persons each participate at both ends. The attenuation value chosen, shows how much worse/better the test system is, compared to the reference system which is in turn the send reference equivalent of the test system. Reference equivalent is negative if the test system is better than the reference system. Otherwise it is positive.

The block schematic used for the measurement of receive reference equivalent is shown in Fig. 4. Here the listeners have to listen in the receiver under test and compare it with the receiver of the standard system (NOSFER). The identical loudness is achieved with the help of attenuator box and the attenuation value indicates the receive reference equivalent of the system under test.

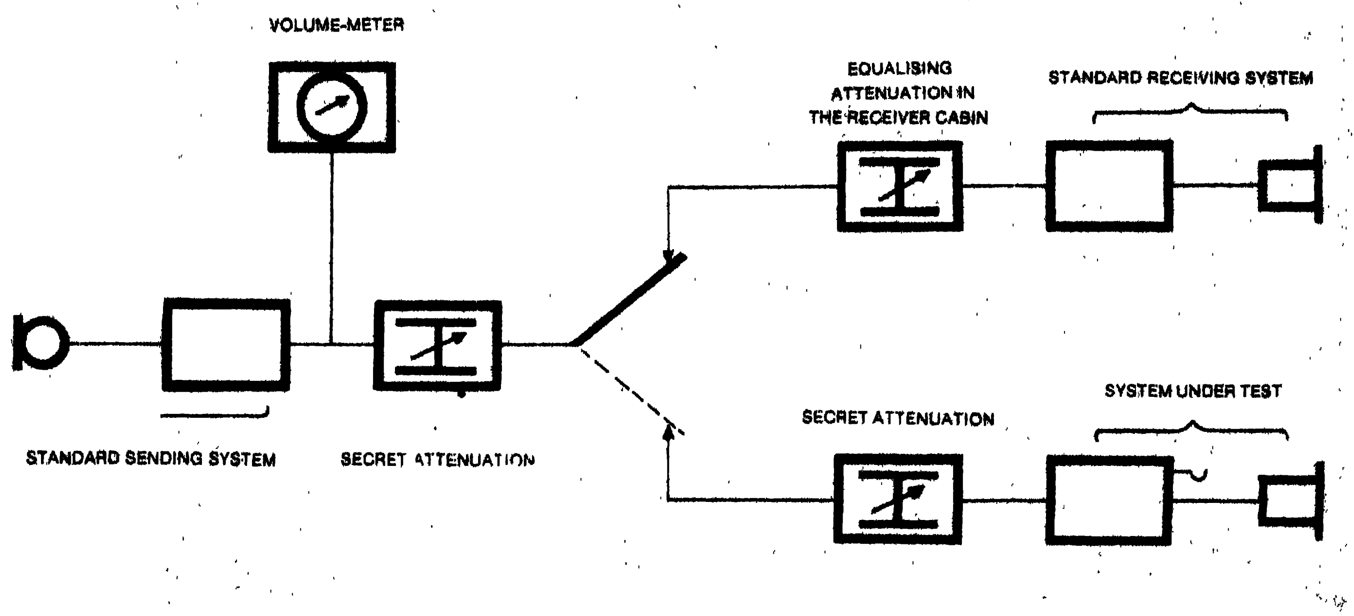

Fig. 4: Measurement of receiving reference equivalent.

The reliability of the measurements of the reference equivalent may be affected by many factors, as for instance the tone and the loudness of the speaker, the variations of the same during measurements, the frequency response of the standard and the system under test, the relationship between the frequency characteristics, the hearing abilities, and the fatigue of the listener etc. The temperaments and the objectivity of the people conducting the experiments also make differences in these measurements. CCITT records these limitations in the following manner:

"A desire to depart from use of reference equivalents as defined by recommendation P72 arises for the following reasons:

1. Reference equivalents cannot be added algebrically, discrepancies of at least ±3 dB are found.
2. Replication accuracy of reference equivalent is not good. Changes in crew can cause changes of as much as 5 dB.
3. Increments of real (distortionless) transmission loss

are not reflected by equal increments of reference equivalents. 10dB increase in loss results in an increase in reference equivalent of only about 8 dB."

Articulation tests

It is the test of intelligibility of the speech sound, which is taken as quality measure. Here one has to distinguish the sound syllables, words and sentences. The ratio between the correctly understood sound elements and the total number of transmitted elements becomes the measure of articulation score. While a well conducted articulation test can provide an enormous amount of information about the speech quality which will be very close to real life practice, they are quite time consuming, requiring a highly trained test team to conduct the test for a fairly long time, sometimes several weeks. Analysis of the test results is also a delicate job which needs expert advice at all stages.

Opinion tests

In these tests, conversation between two teams takes place over telephone connection under test. The participants are then asked to rate the speech quality. Rating is done in five steps starting from bad to excellent. The procedure is repeated many times so that different test variables are taken into account. The opinion score is then combined giving the mean opinion score which is combined in curves.

As is evident, these tests are purely subjective, and reliability is very low since noise level and attenuation play an important role in final results.

Conclusion

Over the last few years, the expectation of telephone users regarding quality of telephone has increased tremendously as quality has become a way of life today. Various telephone organisations in different parts of the world are busy to determine systems for absolute measurements of overall quality of telephones. New parameters for telephone quality are being identified in different telephone laboratories and being standardised by CCITT.

Indian Telephone Industries Ltd (ITI) has been making serious efforts to simplify and standardise the quality assessment methods for telephones. Over the years, several new test arrangements have been developed and many instruments have been added in quality testing labs. In Naini, ITI has imported B & K electro-acoustic telephone transmission measuring system type 3354 for final assessment of telephone quality. A Canadian microprocessor based automatic telephone test equipment is also under procurement. ITI has also established a life test laboratory as well as a climatic test laboratory. Efforts are being made to establish an anechoic chamber for measurement of quality parameters of a telephone under absolute conditions. □

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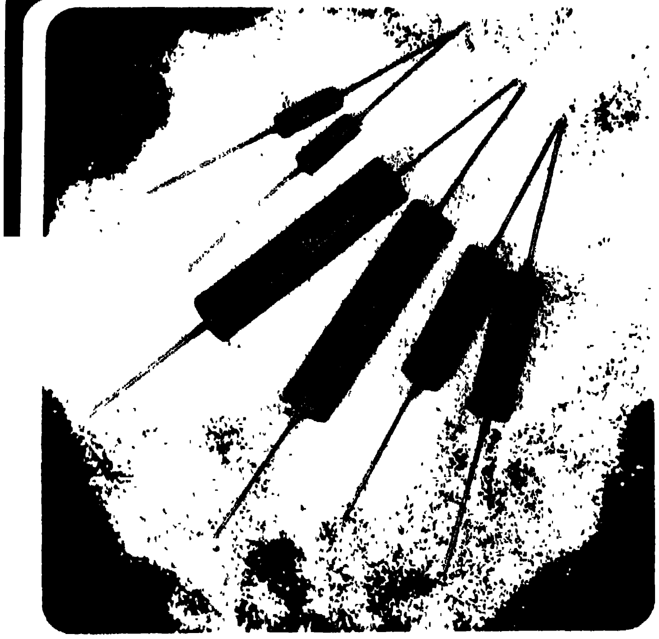

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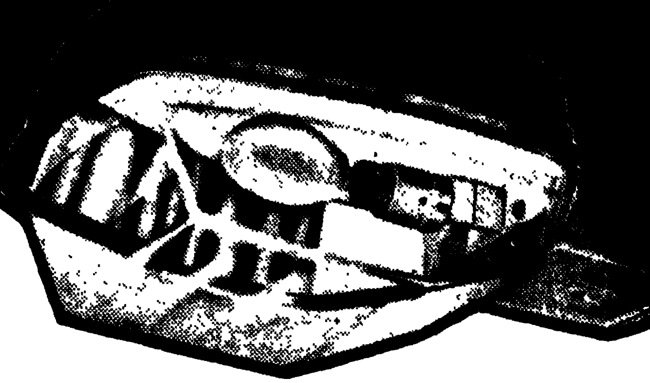

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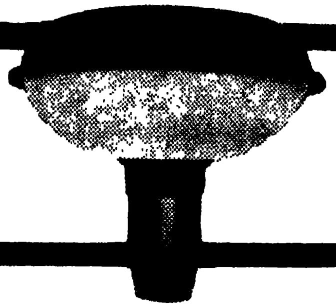

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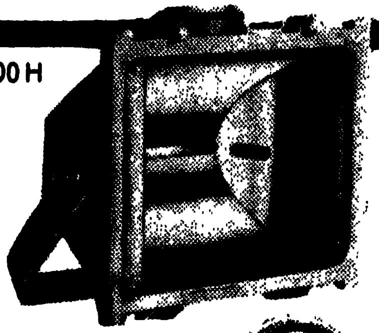

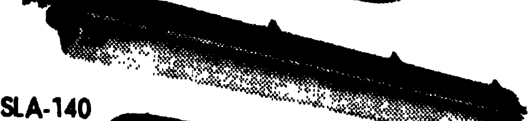

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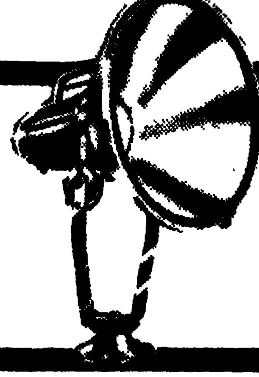

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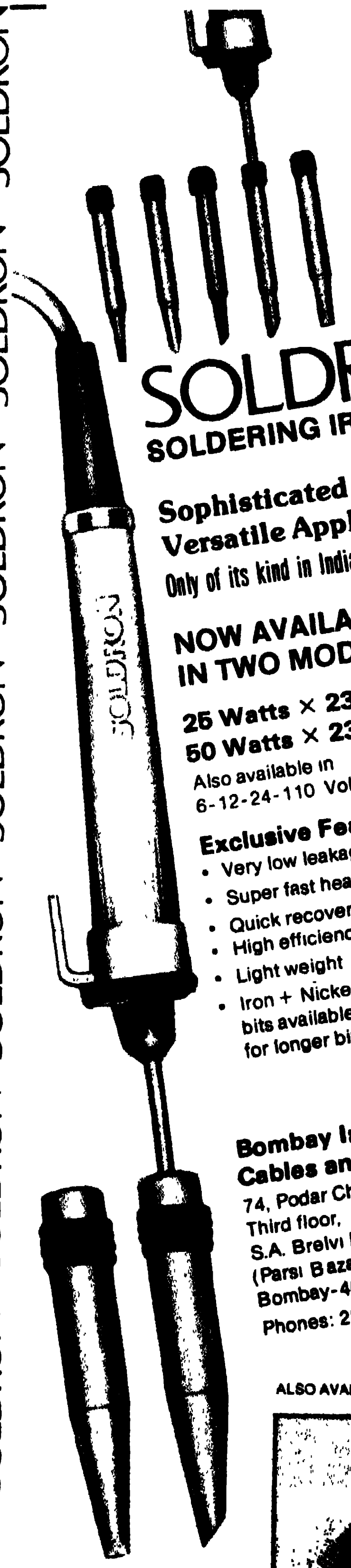

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Electronic Techniques for Automatic Process Control

Part II

A.K. Kapila

The manner in which an electronic controller changes its output relative to input is known as control action. Modern electronic controllers are usually designed to produce a combination of the following control actions: (i) proportional, (ii) integral, and (iii) deviative.

Each control action has its characteristics, advantages and limitations. To select the best possible control action for a given application, it is important that the characteristics of each action are fully understood.

Proportional action

Proportional action is also known as throttling or modulating action. In this action, there is a continuous linear relation between the value of the controlled variable and the controller output. In other words, the controller output changes by the same amount for each unit of deviation. This action responds only to the amount of deviation and is insensitive to the rate or duration of deviation. There is no change in controller output without deviation.

The change in value of the controlled variable that is necessary to cause full change of controller output, is known as proportional band (PB) or throttling range. The proportional band of a particular instrument is usually expressed as a per cent of its full range. In practical controllers, the proportional band may cover less than 1 per cent to much over 200 per cent. Proportional bands over 100 per cent cannot cause full change in controller output even for full range in the controlled variable.

Another concept for expressing action of proportional controller is gain or sensitivity. These terms describe the ratio of controller output to controller input. Mathematically, gain and sensitivity are reciprocal of proportional band. Fifty per cent proportional band corresponds to a gain of 2. The adjustment of proportional action of a controller is calibrated either in terms of gain or in terms of proportional band.

Any change in process load requires a change in controller output to maintain the controlled variable at the desired setpoint. But a proportional controller requires a change in deviation in order to produce a change in its output. Hence, proportional control action can produce an exact correction for only one load condition.

At all other loads, there must always be some deviation left. This is called offset deviation and is an inescapable characteristic of proportional control action. This offset can be eliminated by manually resetting the setpoint to bring the controlled variable to the desired value. However, it must be emphasised that each change in load requires manual resetting of the setpoint which may not be possible if load changes are very frequent.

Proportional control action works best when process capacitance is relatively large, process reaction rate relatively slow, and process lag and dead time relatively small. All these characteristics promote stability and permit narrow proportional band settings which lead to faster corrective action. When process characteristics are less than ideal, a wider proportional band is used even though this increases offset with load changes.

Excessive gain produces over-correction of the controlled variable beyond the setpoint. It reverses the characteristic of overshooting, once it has reached its maximum and is followed by undershooting which means passing the setpoint because of its inherent inertia. The resulting movement is an oscillation around the setpoint.

The magnitude of response can be reduced by reducing the gain to such a degree that no cycling occurs. This results in a sluggish response which is undesirable in a process where quick correction is required.

The necessary compromise for optimum control is a gain that results in a few rapidly subsiding cycles around the setpoint. The gain necessary for this condition depends on the speed and magnitude of the load change and the time required by the control system to correct the deviation. If the process response is fast, a small gain is chosen and vice versa.

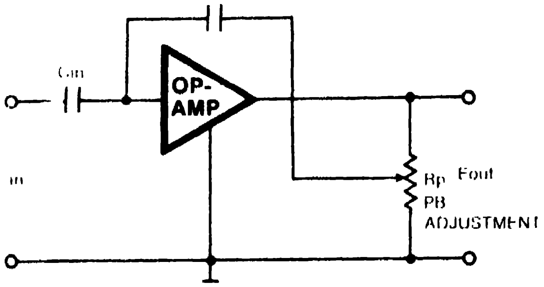

Fig. 4: Controller with proportional (P) action.

High gain results in cycling if process response is too fast. This condition will increase considerably if dead time is present, as it will take longer to correct overshooting. Hence, proportional control should be used in processes with comparatively large time constant and small dead time. The ratio of time constant to dead time should be large, the magnitude of load changes should be small while speed of load changes can be large.

Fig. 4 shows the schematic of an electronic controller with proportional action. The effective ratio of the value of the input capacitance and the feedback capacitance determines the proportional band. The effective value depends not only on the capacitor size, but also on voltage gain of the amplifier. If the effective ratio is 1:1, then the proportional band is 100 per cent.

Proportional band can also be adjusted by regulating the PB control potentiometer. By this adjustment, the amount of output that is used in the feedback circuit can be varied. With a decreasing feedback signal, a larger output must be produced to fully charge C_{fb}. An increased output for a given input is merely a narrowing of the proportional band. A full range of output signals can, therefore, be produced by a small input signal.

Integral action

Also known as proportional speed floating action, the controller output in this action changes at a rate that is proportional to deviation. In other words, the greater the deviation, the faster the controller output changes. As long as the deviation persists, the controller output continuously changes. It responds to both the amount and time duration of the deviation. Thus, this action continues to operate until it does produce an exact correction for any load change. This is the unique advantage of this action over any other action.

Since its rate of correction increases with the size of the load change, it is able to operate well with comparatively fast load changes. For the same reason, the amount of self-regulation can be considerably less.

This action is suitable for processes with small time constant and small dead time. The ratio of time constant to dead time should also be small. It can handle large load changes.

Fig. 5 shows the schematic of controller with integral action. A voltage divider is placed across the input and a variable resistor is placed in parallel with C_{in} for integral action. The voltage divider and variable resistor provide a path for current flow whenever an error signal exists.

This current provides a continuous amplifier input whenever the process variable differs from the setpoint. Feedback current, therefore, continues to charge or discharge the feedback capacitor as long as there is an error input. The amplifier then produces a continuous change in output as long as an input signal exists. This, by definition, is the integral action, since the controller is seeking the null position.

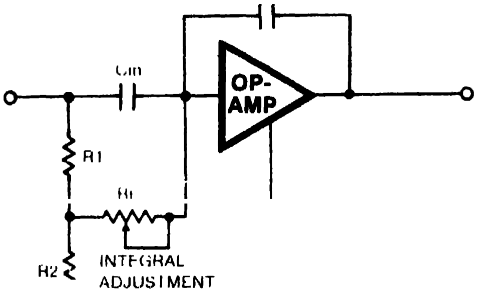

Fig. 5: Controller with integral (I) action.

In this circuit, the only time that the input current stops is when the error voltage is zero. By decreasing the value of integral resistor, input current is increased for a given input signal. The output current must increase at a faster rate in order to produce a matching change across the feedback capacitor. The result is a faster integral rate.

Increasing the size of integral resistor results in a slower integral rate. To produce a very slow integral rate, the voltage divider has been incorporated in the input circuit. The voltage divider causes the integral resistor and amplifier to recognise a smaller portion of the input signal, resulting in a smaller charging current. The input capacitor, however, still recognises the full input voltage. The value of integral resistor determines the number of times that the proportional action is repeated per minute.

Derivative action

This action is also known as differential or rate action. In this action, the controller output is proportional to the rate of change of the controlled variable. The derivative action has a great stabilising effect on control because it opposes any change of the controlled variable. This action has no effect on offset error.

The derivative adjustment is expressed by derivative time in minutes. It is the time by which the derivative action advances the effect of proportional action.

Derivative control is an anticipatory type of control, sometimes called preact, booster action or error-rate damping, in which the correction speed depends on how fast the controlled variable is deviating from the desired setpoint. It measures the rate of change of error and as a result can predict a large overshoot before it occurs so that it can apply corrective action to limit it. As a result, oscillations are reduced.

In this action, either the controlled variable signal or the output signal to the final control element is increased in proportion to the rate of change of signal. The effect is similar to that of a temporarily increased gain. The result is that even a sluggish corrective action becomes sufficiently rapid to furnish satisfactory control.

The acceleration of a changing signal which is inherent in derivative action makes it valuable for long time constants with initially small responses.

The most notable advantage of using derivative action for counteracting the effect of dead time is the reduction of the period of cycling. Thus, the controlled variable is stabilised at the setpoint more quickly when load changes occur.

Derivative time is adjusted to change the response in accordance with the amount of process lag. On process start-up, the initially large correction provided by the derivative action brings the controlled variable to the setpoint very quickly, reduces overshoot, and cuts both the time and the magnitude of cycling.

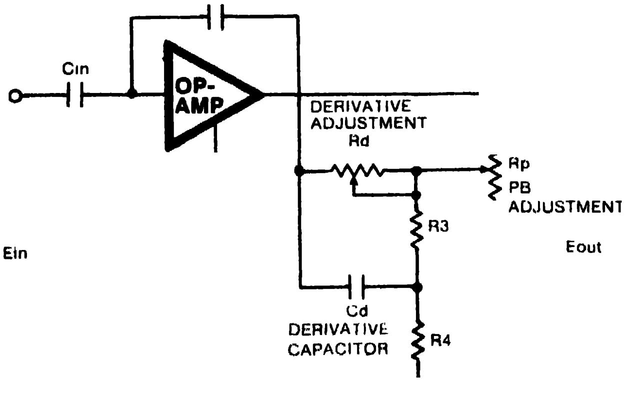

Fig. 6: Controller with derivative (D) action.

Fig. 6 shows the schematic of controller with derivative action. The derivative action is accomplished by the addition of a voltage divider, a variable resistor, and a capacitor in the feedback circuit.

The input error signal change produces an output change that is easily passed by the derivative capacitor. Since this change is taken from across the voltage divider, the result is that the feedback capacitor recognises only a portion of the output. The effect is similar to a decrease in the proportional band control, i.e. the instantaneous effect is a narrowing of the proportional band. This results in a greater output change for a given input until the derivative capacitor charges.

The time taken by the derivative capacitor to charge depends on its time constant. This can be changed by the variable resistor - the derivative time adjustment. As soon as the derivative capacitor charges, the effect of the voltage divider disappears. The proportional band is then restored to its original value. Derivative amplitude will be determined by the voltage divider. This, of course, determines the amount of instantaneous change in the signal fed through the derivative capacitor.

Proportional-cum-integral action

It has been seen that integral action is capable of providing exact correction. Thus, by combining integral action with proportional action, the undesirable offset characteristic of proportional action can be overcome. This combined action is also known as reset action. The major advantage of this action is that control without offset error is possible under all load conditions.

The integral rate adjustment alters the rate of change of the integral component. Integral rate is usually expressed in repeats per minute. This term denotes the number of times per minute that controller output due to proportional action is repeated by the integral action.

The effect of integral action is to add corrective action to the process as long as the deviation exists. This is the same as shifting the setpoint gradually, forcing the controller to follow until the original setpoint has again been reached.

When the deviation occurs, there is an immediate response from the proportional action. This response is increased at a fixed rate by integral action. The output of the controller is proportional to the magnitude and duration of the deviation. This causes prolonged cycling when the load changes occur too rapidly.

This action is suitable for processes with small time constants and small to medium dead times. However, the ratio of time constant to dead time should be large. Large load changes at a slower rate can be handled by this action.

The integral rate adjustment, in combination with the proportional band setting, determines the rate at which the proportional band is shifted when a deviation occurs, and is set in accordance with the process requirements. With a given setting, integral rate is proportional to the amount of deviation of the controlled variable.

When the controlled variable is returned to the setpoint, integral action ceases to shift the PB and leaves it in the position attained at that time. The integral response also depends on the PB setting, being inversely proportional to width of the PB.

The proportional-cum-integral mode of control (PI) is the most useful among all modes. It can handle most combinations of process characteristics satisfactorily. Small capacitances permit a higher integral rate, and enable the controller to counteract offset more quickly. Transfer lag and dead time in the controlled system, however, require a decreased integral rate in order to avoid excessive cycling of the controlled variable.

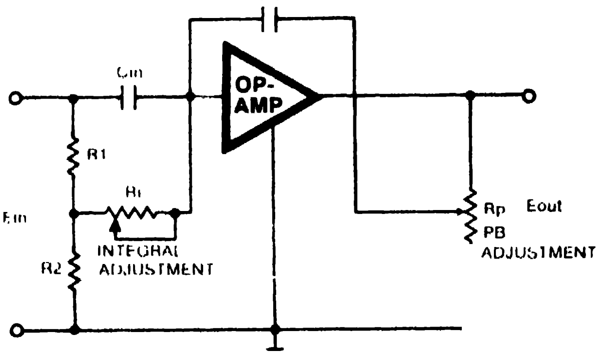

Fig. 7: Controller with proportional-cum-integral (PI) action.

The limitation of the PI control lies in the large period of cycling and the attendant slow response when appreciable dead time is present in the controlled system. Transfer lag is not a serious limitation as long as the measuring device is sensitive. If the measuring device is sluggish, transfer lag is converted to a dead time and PB must be wider with a slower integral rate.

Fig. 7 shows the schematic of controller with PI action. Rp is the proportional band adjustment and Ri is the integral adjustment. The proportional control introduces negative feedback to give stability to the system. The integral control provides a delayed positive feedback to nullify the effect of negative feedback and reduces the proportional band of the system to remove undesirable offset. This positive feedback is introduced with a time lag so that the proportional band will be reduced after it is no longer needed for stability.

Proportional-cum-integral-cum-derivative action

Proportional, integral and derivative actions can be combined in one controller to obtain the advantages of all these actions. A controller combining all these actions is known as PID controller. The output of a PID controller depends on the magnitude, duration and the rate of change of the deviation.

This action might be required where only proportional control would allow the controlled variable to have an excessive offset, when the input changes at a constant rate, and where the incorporation of only integral action would give too small a margin of stability. The addition of derivative control then has the effect of stabilising the system by increasing the damping.

This action overcomes limitations of all other types of control actions. It contains the compensation for large time constants with initial slow response of the derivative action. It also combines the favourable response of proportional action to fast, though small, load changes.

Slow but large load changes can also be handled by the proportional-cum-integral action. Hence, this action can be used for any difficult application where time constant may be small, dead time may be large and load changes may be relatively large and fast.

Processes with a dead time of more than 2 minutes or a large transfer lag are sometimes difficult to control, even with the proportional-cum-integral mode. The proportional band must be set exceptionally wide and the integral rate usually slow in order to avoid excessive cycling. Thus, when load changes occur, there is a rather large deviation, and it takes a long time for the controlled variable to return to the setpoint. In such applications, which are most often found in temperature control, the addition of derivative action to the proportional-cum-integral mode usually solves the control problem.

Basically, the derivative action provides an initially large correction when a deviation occurs, so that the final control element initially moves further than it normally would with proportional-cum-integral action. Then, having made this large initial correction, the controller functions to remove this effect, leaving only the corrective action of the proportional-cum-integral response to determine the position of the final control element. The result is an early, extra change in the process input, which tends to counteract the unfavoura-

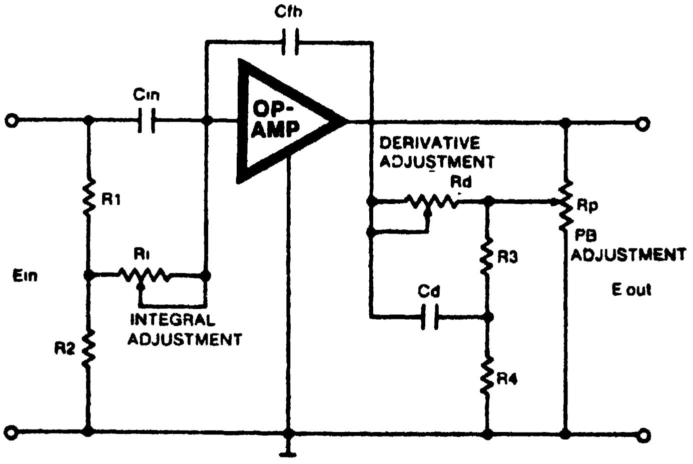

Fig. 8: Controller with proportional-cum-integral-cum-derivative (PID) action.

ble effect of process lag. It is a temporary overcorrection proportional to the amount of deviation.

Fig. 8 shows the schematic of a controller with PID action. Proportional band control adjustment is used to regulate the gain of the system by changing negative feedback to suit the characteristics of the process. Integral adjustment is used to provide positive feedback to eliminate offset when load changes. Derivative adjustment supplies negative feedback which produces a control response proportional to the rate of change of the controlled variable.

System response

A load change in the control system causes the controlled variable to deviate from the setpoint and thus produce an error. The controller then attempts to return the controlled variable to the desired setpoint.

Ideally, a disturbance in the control system should cause the system to respond instantly to produce the exact conditions required. This is impossible in practice owing to various characteristics of the controlled process and control system such as dead time, time constant and damping.

The initial error causes the system to respond in such a way as to reduce the deviation of the controlled variable from the setpoint. The corrective action produced by the final control element, however, usually causes the controlled variable to overshoot the setpoint, thus reversing the error.

The system then starts to correct this error and, as a result, the controlled variable this time undershoots the setpoint with further reversal of error, and so on. In this way, the oscillations of the controlled variable occur in response to a load change.

A system is considered to be unstable if the amplitude of the oscillations is maintained after a disturbance. A stable control system is one in which oscillations introduced into the system die out as time increases. The oscillatory response of the controlled variable to a disturbing signal before the system returns to a quiescent state is known as transient transponse. The response of the controlled variable to a disturbing signal after oscillations have ceased is known as the steady state response.

The type of response that the system makes to load changes is the criterion of the quality of control. The problems concerned with the design of control systems centre around the need to provide stability along with rapid response under normal operating conditions. Systems can often be made stable by introducing various forms of time lag into the system, but if the system is excessively stable its response may be too slow.

Stable systems exhibit several types of response, depending upon their design. The response may be oscillatory with a constant amplitude; it may be oscillatory with a decreasing amplitude; or it may be smooth curve. The most acceptable response is often the form in which the amplitude of each successive overshoot following a disturbance is about one quarter of the previous overshoot.

Selection of control technique

Probably the most difficult decision for automatic control of a process is the selection of an adequate, yet economical, control technique. The solution is usually a compromise between the quality of control desired and the cost of the control system. The control system must be adequate to meet the tolerance of the process, but it should not include refinements beyond those required or its cost will be excessive.

The cost of a control system must be evaluated in terms of what it accomplishes. A mistake often made in the selection of a controller means sacrificing quality to minimise the original cost. This may result in increased maintenance costs, and, as a by-product, loss of production time. These two factors—production loss and maintenance cost—are usually more important than the original cost.

Most control systems are installed with a life expectancy of more than ten years. In many cases this minimises the significance of the original cost.

As plant situations are analysed, it becomes evident that control sophistication and complexity can work against plant efficiency as well as for it. A complex control system that is highly advantageous in one plant where skilled operators and maintenance people are available, might create severe production losses when operated and maintained with less skilled workmen. The experience level of operators and maintenance people must be considered before selecting a suitable control system for a plant.

Each mode of control is applicable to processes with certain combinations of basic characteristics. It is important to remember that the simplest mode of control which will do the job is the best one to use, both for reasons of economy and for best results. Frequently, the application of a very complicated control mode will result in poor control and contribute to the undesirable characteristics of the process.

When narrow proportional bands are used, the integral action is generally not required. Under such conditions, the controller applies large corrections for deviation and offset will not exist even with load changes.

Derivative action is used to reduce long lags. In the measurement and control of rapidly changing variables such as pressure and flow, the addition of derivative action may actually increase the error instead of correcting it. In the measurement of flow with a differential pressure type of instrument, which responds very rapidly, pulsations in flow from reciprocating pumps and compressors will be picked up and transmitted to the controller. The derivative action in the controller will accelerate the corrective action in response to these pulsations and cause rapid opening and closing of the final control element and its ultimate failure.

Considerable experience is required in the selection of the correct mode to suit a particular process. Proportional mode is generally used in processes with fast or medium reaction rate and small or moderate transfer lag or dead time when load changes are small and slow. Pressure and liquid levels are essentially single capacitance processes and come under this category.

Proportional-cum-integral mode is generally used in processes with negligible capacitance as well as small transfer lag and dead time when load changes are slow. Flow control applications come under this category.

Proportional-cum-integral-cum-derivative mode is generally used in processes having two or more capacitances with large transfer lag and dead time when load changes are large and frequent. Temperature control applications come under this category.

Computer techniques

The increasing use of electronic controllers in recent years as hastened the use of computer techniques for automatic process control. Today, large chemical plants being built are using the latest available electronic hardware, computer controls and advanced control concepts such as adaptive and optimal control.

There has been much debate in the past among control system designers about the relative merits of computer versus conventional control systems and direct digital control versus supervisory control. Each system has its own merits. The designer must judiciously select from among these alternatives a system which meets his requirements. No single system is universally superior in all applications.

Computers are now being used to control directly, to perform economic optimisation calculations, to make heat and material balance calculations or simply perform the conventional monitoring, logging and alarm functions. Large computer systems being built today have fully redundant computers with complete, fully automatic transfer of data and controls in the event that on-line computer fails. These systems include sophisticated display features and require complex interface hardware and software techniques.

Minicomputers are being increasingly used in large chemical plants to perform many of the logic and control functions normally associated with conventional controllers. Attractive economic benefits can be realised by controlling and optimising only a few critical loops in a process by using minicomputers. In this way, many of the advantages of computer systems can be obtained with a low capital investment and operating risk. Moreover, these systems can be linked to an overall hierarchial computer management system when the need arises.

There have been significant advances during recent years in the application of advanced control techniques and sophisticated data acquisition, monitoring and control systems in process plants. However, recognition of these advances does not warrant scrapping of existing conventional control systems. Existing controls can be replaced by better and sophisticated controls only when this replacement can be economically justified. □

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GT — Go until breakpoint
MM/S/D — Memory Modify/set/Display
LO — Load
NOBR — Remove breakpoint
NOPA — Reset printer attach
PA — Printer attach
RX — Individual register display/change
TR — Trace
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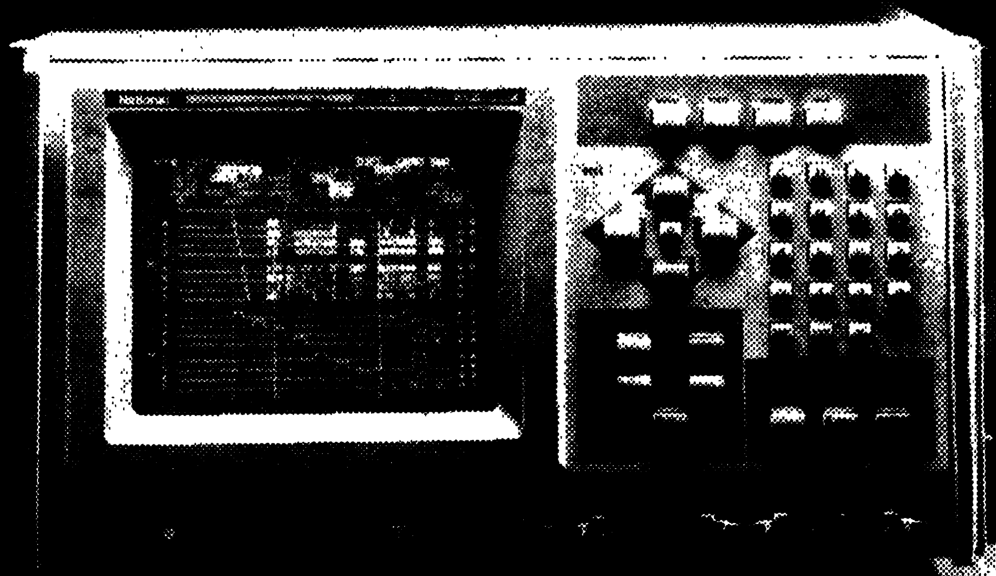

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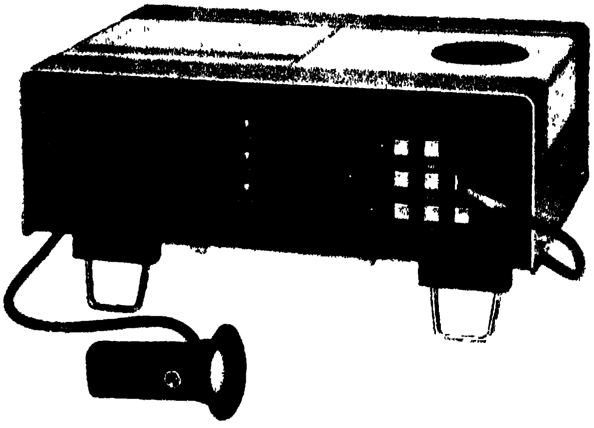

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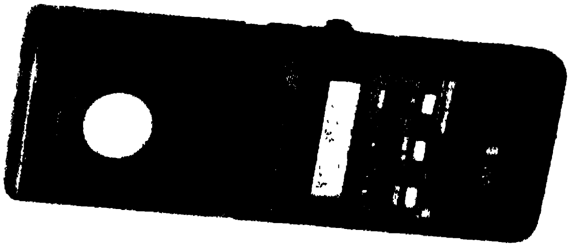

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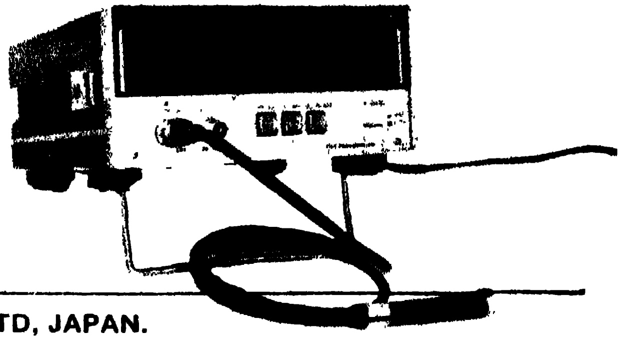

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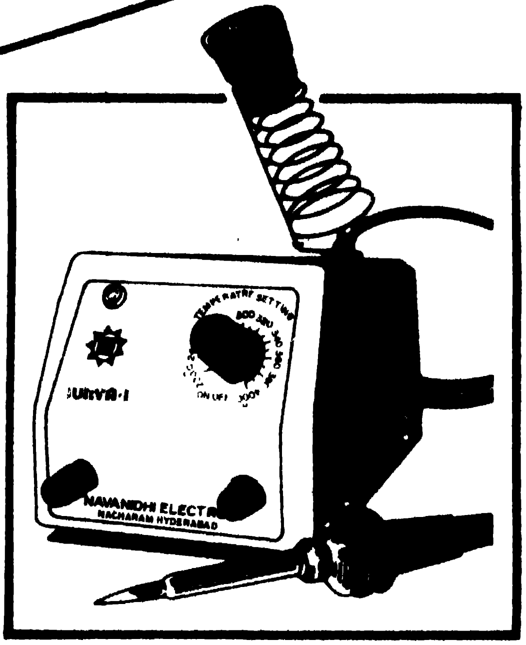

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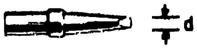
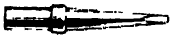
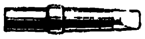
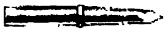
1		SCREW DRIVER TIP	HSD11 HSD12 HSD13 HSD14	1·6 2·4 3·2 5·0
2		LONG SCREW DRIVER TIP	HLS21 HLS22	2·0 3·2
3		CONICAL BLUNT TIP	HCB31 HCB32 HCB33	2·4 3·2 5·0
4		NARROW SCREW DRIVER TIP	HNS41	0·6
5		CONICAL LONG TIP	HCL51	0·8
6		SPECIAL TIP	HST61	2·7

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-2B	SOLDERING IRONS	25 W
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-3A	SOLDERING IRONS	15 W
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Feedback Phase to Face

Part IV

A.V. Jacob

Unlike the positive feedback blocks seen so far, regeneration forces both the sections to go into conduction. Once it reaches the state of conduction, it is no longer a slave of gate signal. The system latches on to a new state and remains there as long as the system is uninterrupted. It can be reverted into its original state only by cutting off the source of energy which helps in sustaining the life of the system. The negative slope portion of the current voltage characteristics is the result of positive feedback and its successive amplification, which eventually leads to short circuiting or shunting action of the device.

The process of relaxation is based on the return of the state of a system to its original condition after a brief disturbance. The disturbance may be external or may be due to feedback generated within the system itself. The system is liable to absorb the command and succumb to it. It can assume only one of the two specific states.

The periodicity between the active and passive states can be controlled externally. In fact, the input of the system can only be of importance in overturning a given state. Thus if the output information is to have some meaning, it is mperative that the input also should have a predictive ature. The system accomplishes this action, subject to prac-al limitations, in absolutely regenerative positive feedback within itself. It can be thought of as a system that has two quasi-stable states of equilibrium, in each of which the operating parameters change slowly until critical values are reached at which transition takes place very rapidly to the other state.

The useful properties of relaxation devices include their ability to generate non-sinusoidal waves of desired form which are rich in harmonic contents. Such devices have susceptibility to tuning and modulation by means of a direct voltage and can be synchronised to a frequency approximating a multiple or sub-multiple of the frequency of oscillation of the circuit.

Delayed feedback of appropriate magnitude is the secret of square wave and pulse oscillators. Perhaps the term 'gain' is never fully proper for use with reference to these systems.

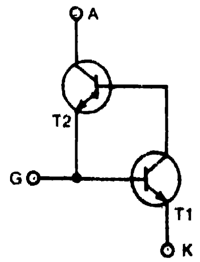

Fig. 25: Schematic configuration of a SCR.

While avoiding the term gain or amplification, it is still possible to state some characteristics of the typical relationships between input and output magnitudes for signals in typical reflexes.

The reciprocal feedback system shown in Fig. 26(a) is called a multivibrator. The feedback is delayed by a factor of fixed magnitude to improve its intelligibility and the delays in both the branches may not be identical. As might be imagined, reciprocal feedback systems are not complex. One unit is interested in the lateral inhibition of the other. Two inhibitory actions are followed by two sign changes in any signal as it passes round the loop. Perhaps it does illustrate a serious point. The system has a positive feedback but it differs from a simple feedback system by the fact that it has two inputs and two outputs. The loop gain is high and a threshold occurs in the pathway.

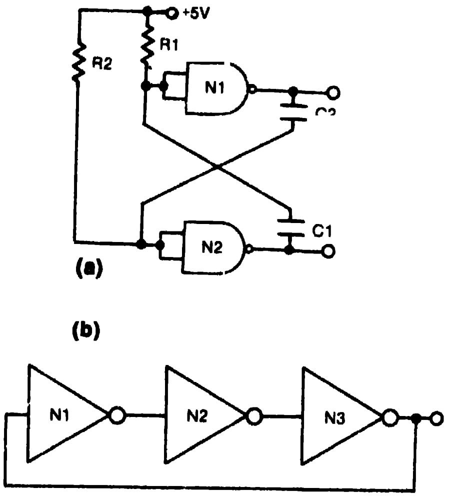

Fig. 26(a): Multivibrator using NAND gates. (b) The reciprocal feedback system using inverter gates.

The best known temporal effects are produced by simple delays. One class of operations which modifies signals is the alternation of temporal relationships in the signals. Delay of one signal can provide a temporary storage of that signal which allows it to interact with a large signal. The system relies on positive feedback. Temporary storage of information lasts only for a definite multiple of the delay factor.

It follows from all this that the amplitude is independent of frequency. Consider, for example, an odd linear combination of inverter gates where the output is tied back to the input of the chain. The output remains oscillatory as a consequence of the propagation delays introduced by each gate and it does not wait for a separate control input. Assuming that all the gates have approximately equal propagation delay, the time period of oscillation equals '2tn', where 't' is the propagation delay and 'n' is the number of inverter gates (odd) employed in the system.

Negative resistance devices that have more than one stable states are the cornerstones of digital memory. In the first place, they are completely non-reactive at all frequencies which means that in an ideal case there is no circuit capacitance or inductance. This requirement is obviously almost impossible to fulfill because in any physically attainable circuit, there are always shunt capacitance and series inductance.

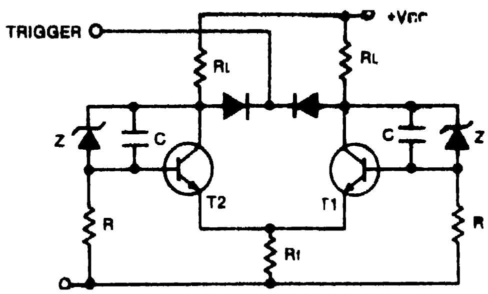

Fig. 27: Schematic showing Eccles-Jordan bistable circuits.

Secondly, the states can be made completely symmetrical. A symmetrical circuit has equal magnitudes of currents and voltages in the possible stable states of equilibrium and each respond identically to the external commands that switch it from one state to another.

Eccles-Jordan bistable circuits (Fig. 27) apparently arose from the feature of positive feedback between the systems and their mutual inhibition cum dominance. The active state of T1 also means the passive state of T2 and vice versa. The reduction of positive feedback or the introduction of negative feedback is partially prevented by the presence of capacitor C across the zener. These capacitors cannot charge or discharge instantaneously on the arrival of the command signal.

Rapid changes of collector voltage of one active device

Break Frequency

The frequency where the magnitude of an output voltage or current has dropped to 0.707 of its mid-frequency value is called the break frequency. The basic reason for the selection of this unusual number is that for a sinusoidal wave its RMS (root mean square) value is equal to 0.707 times its maximum value, i.e. 0.707 is approximately equal to the reciprocal of crest value.

The crest value for sinusoidal waves is equal to 1.414, which is the square root of 2. The relationship between the RMS value and maximum value is specified in terms of current by the equation

$$Im^2 = 2\,I^2_{RMS}$$

For a wave of any form, the ratio of maximum to RMS value is called the crest, peak or amplitude factor.

The break frequency is also known as 0.707 frequency or the band edge. The significance of 0.707 frequency ita- more apparent with a resistive load to the amplires of where the output power will be dropped to 0.5 (v ase locked the square of 0.707) of its mid-frequency va pted for their break frequency. That is why the break often termed as 'half power frequency width modulated ratio of 2 is approximately equal to along with thyristors is break frequency is also known a the power supplies.

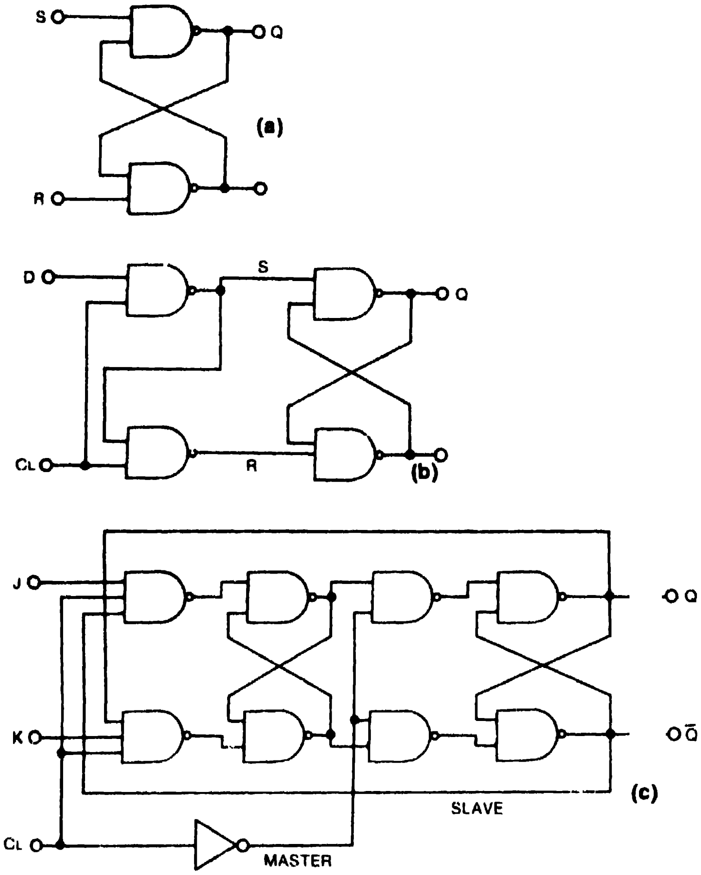

Fig. 28(a): Simple RS flip-flop using NAND gates. (b) Incorporation of gates in RS flip-flop. (c) The master-slave JK flip-flop.

during its transition are reflected on the base voltage of the other active device. Speed-up capacitors, as they are often called, ensure that transistors conduct alternately when the successive command pulses are used to trigger the circuit. Maximum open loop gain and hence a high speed transition between the states is made possible by the zener diode, which practically forms an open circuit if the collector voltage is held below its breakdown level.

The multiple feedback system, an even more common deviation from simple feedback systems, is found to be more effective in storing bits of previous information. Clearly, these are multi-input/output systems and the interaction between the inputs, whether it is derived from the external source or from the output of the system itself, will determine its current status. Delay in the positive feedback path may be equal to zero or an integral multiple of the delays of input signals

A simple set/reset flip-flop has two basic blocks, mutually monitoring individual outputs so that their states can be controlled upon the external commands. The delay involved in the process of feedback is close to zero. Various forms of flip-flops such as data, toggle, master-slave JK etc employ similar strategies where delay is made a function of the input signal itself. Note that the behaviour of the circuit is different depending upon the relative magnitudes of the delays. This may give rise to a phenomenon called 'critical race.' It should be noted that logic '0' applied to S and R inputs simultaneously in a NAND flip-flop is a disallowed input condition since it produces an invalid output state with both the outputs at logic '1'.

In applications such as memories, it is necessary to remember what the logic state of a single input has been, even after the input has subsequently changed. An additional gate technique is adopted in S/R flip-flop to isolate the data input from the flip-flop after the desired data have been stored (Fig. 28(b)). With this modification, so long as the clock input is held high, the Q output of the S/R flip-flop will follow the data input. However, once the clock goes low both the inputs to the flip-flop are held at logic '1' so that it will no longer change state and whatever data were present before the clock transition are stored.

The master-slave JK flip-flop is considered as the universal flip-flop. It can be used as an R/S flip-flop by using the preset and clear inputs. It can be converted into a D (data or delay) flip-flop by connecting an inverter between J and K inputs. A toggle action follows if J and K inputs are held high. This versatility is floated on the system by the judicious use of feedback techniques.

If the Q output of the slave is initially low, then the master flip-flop will be set by a high at the clock input. The slave remains reset, however, so there is no danger of the feedback to the master section.

When the clock input goes low, the information is transferred from master to slave because the inverter in the clock route enables the slave section to receive the relevent information from the master counterparts. This is followed by a change in feedback to the master section, thereby resetting it to its initial state. Note that the behaviour of the flip-flop can be predicted by observing the J and K inputs in the previous interval just before the occurrence of the trailing edge of the clock pulse.

Ring counters use an integral multiple of delay with respect to the input signal. Once the desired state is reached, a feedback is applied instantaneously to the inputs. The purpose of the feedback is to preserve the information content and shift it in the specified direction at the speed of the clock pulses. All the flip-flops in a given chain of the ring counter will change their status simultaneously, hence the name synchronous counter (Fig. 29). If all Q outputs are

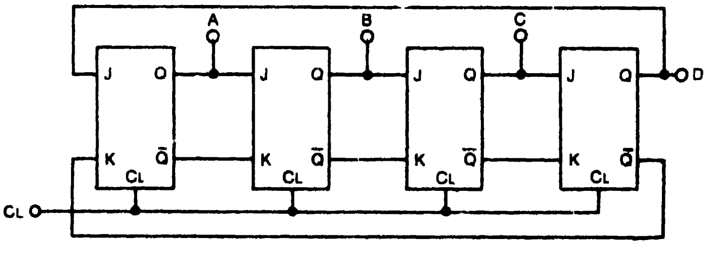

Fig. 29: Flip-flops in a chain formation.

initially held at zero, the system is bound to reject its input commands. A start signal is therefore necessary to load the counter with specific information.

Johnson counter, or twisted-ring counter, eliminates the problem of starting the signal by cross coupling the feedback lines. Information storage or counting is synchronous and the system is self-starting. Such a counter has '2n' unique states, where n is the number of flip-flops in the counter (Fig. 30).

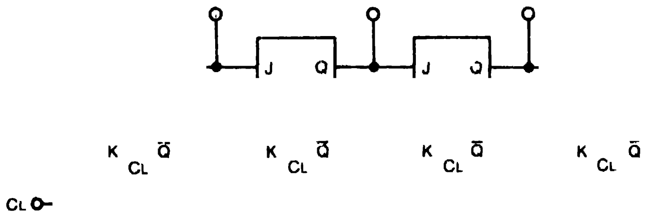

Fig. 30: Johnson counter using number of flip-flops.

Asynchronous or ripple counter also makes use of feedback technique, mainly to bring back the system into the initial status. Here the changes in the blocks are not simultaneous and the feedback may not necessarily be from the final output (Fig. 31).

The ripple counters are less complex and less expensive but provide a lot of unwanted spikes during state transitions. With the help of proper feedback sections and gates, they can be converted into both up counter and down counter. Several different types of counters are available to the designer, varying mainly in the feedback pattern rather than the basic configuration. Note that in a shift register the cornerstone of the counter family is quite restrictive such that it cannot go from just any state to another.

The innocuous switches at the gates may burst with incisive glitches and sproggies when they are operated, which can upset the digital applecart. Minute changes in applied voltage between the upper and lower threshold at the input generate invalid changes at the output of the logic gate.

Contact debouncer, the checkmate for the display of anger of the gate at its switching, is a simple case with no delay of feedback into the same system to store the information for a period decided by the external source (Fig. 32). The very first crossing of the input voltage over the upper threshold takes the output to high state and it is fed back instantly to the input to maintain its newly acquired state. However, a residual error may be expected at the equilibrium state.

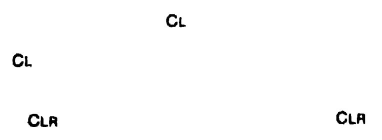

Fig. 31: Schematic showing changes in flip-flop chain.

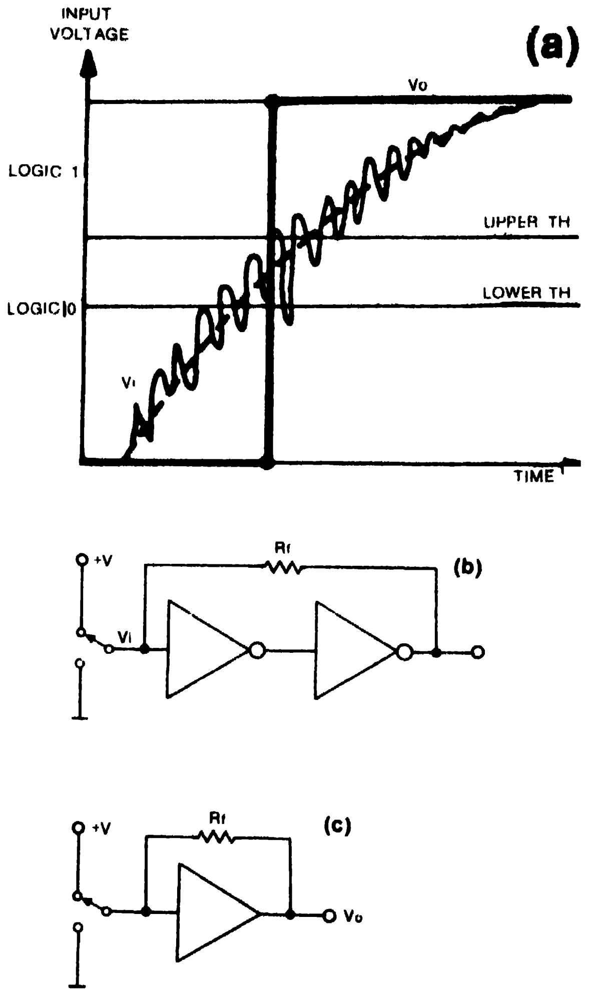

Fig. 32(a): Debouncing circuit using inverter gates. (b) Debouncing circuit using buffer gates. (c) Graph showing first crossing of the input voltage over the upper threshold level.

The principle of the phase locked loop (PLL) is not new. It was used in some deluxe communication receivers in the mid-1930s. Later, it was found to be highly effective in TV receivers for the synchronisation of the vertical and horizontal deflection units. PLL circuits are extensively used in CB transceivers, frequency synthesisers, function generators etc.

Phase locked oscillators exhibit comparatively high stability and low phase noise which are the desired features of the local oscillator in UHF digital radios. The phase locked sources in communication systems are accepted for their spectral purity. The efficiency of pulse-width modulated bridge rectifier using a PLL system along with thyristors is considered to be 'the ultimate' in the power supplies.

In principle, a PLL circuit can be likened to an op-amp connected with feedback, such that the output voltage of the op-amp varies to keep a similar voltage at both inputs. The PLL circuit varies the frequency of its output, so that the frequency of both its input signals remains the same. Seemingly, there isn't anything remarkable about its operation. It is a type of servo system whose output frequency locks on to, and follows, an input reference signal. Furthermore, its output frequency can be an integral multiple of, and in phase with, the input frequency. Hence, it is logical to begin with a description of the entire PLL circuit and its operation in general.

The PLL system consists of a phase detector, a low pass loop filter and a voltage controlled oscillator or VCO. Essentially, it is a control system in which the control is based on the phase difference between the input signal and the signal from the VCO. In a conventional automatic frequency control system, some difference of frequency is required to produce an error signal. In the PLL, only a difference of phase within each cycle results in a precise correspondence between the input signal and the VCO output.

The input reference signal and the output of the VCO are locked in phase by comparing the phase of the two signals in a detector that converts any phase difference into an error voltage or current. The magnitude and polarity of error voltage proportionally shifts the phase and frequency of the VCO in the direction that causes it to track the input frequency and phase. The speed with which the PLL adjusts the VCO to follow up any change in the input frequency depends on the low pass filter, which in turn determines the bandwidth of PLL.

If the frequency of the VCO is exactly equal to the input, the error signal can be evolved only in the phase difference between these signals. The phase difference (ϕi - ϕv) is detected and a corresponding voltage is produced as Vd (Fig. 33). Since the expected variations are small compared to the frequencies fi and fv, the error voltage Vd is subjected to a low pass filter and if necessary the filtered voltage is then amplified to a satisfactory level so as to control the VCO operation.

Any tendency of either fi or fv to change will result in a increase or decrease of (ϕi- ϕv) and the filtered voltage Vd. This process ultimately leads to a state where (ϕi- ϕv) is equal to zero or fi is exactly equal to fv. Now the system is said to be in lock.

In the correct sense, the system is a proportional controller with a phase error inversely proportional to the loop gain. Since the phase of a signal is the time integral of its frequency (frequency is the time derivative of phase), the whole system operates as an integral controller with respect to the frequency.

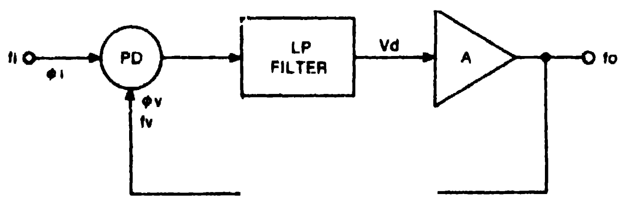

Fig. 33: Block diagram of a phase lock loop (PLL).

When the system is not in lock, there are two distinct possible outcomes. If fi differs from of fv up to a certain value determined by the components of the system, the feedback voltage will differ proportionately, eventually driving the system into the lock. For this (fi-fv) must lie within the passband of the low pass filter. Once it is in lock, the VCO frequency is identical to that of the input signal.

The action of the loop causes the phase to take on just that value which is required to generate the DC control voltage necessary to change the frequency of the VCO from its free running value to the frequency of the input signal. This action allows the PLL to track frequency changes of the input signal once the lock has been acquired. The range of frequency over which the PLL can acquire lock is known as the capture range. However, beyond a specific range, (fi-fv) will not create any impression on Vd mainly by the low pass filter, due to which the PLL behaves like a helpless onlooker.

The loop transfer function H(s) is the ratio of the phase angles ϕv(s) to ϕi(s). The performance of the loop is dependent on the form of filter which may be a simple lag or lead network. Active equivalents may also be used for better tracking ability of the system. However, the constraints in the selection of filters are the conflicting requirements of bandwidth. The bandwidth should be as narrow as possible to avoid phase jitter due to noise. On the other hand, for best tracking and acquisition or for minimum transient error due to signal modulation, the bandwidth should be as large as possible.

It is difficult at this point to suggest what the state of electronics without feedback would be like. Opinions concerning the role of feedback have changed radically in the past few years. The present single and dual loop feedback are not suitable for a number of reasons, including the loss of amplitude and the inhibition and modulation of the actual signal. Observations indicate that there is a best frequency for a given set of operating conditions and away from that, the system evokes subtle variations. In the recent past, considerable interest has developed in the possibility of multiple feedback for the optimisation of man-machine systems.

A great deal of theoretical as well as experimental research will be needed before further significant progress can be made. However, the general approach of the feedback model still stands as the best means to probe into some well defined situations. Here, no attempt has been made to be all-inclusive. The simple systems reviewed here are meant only as a starting point for limitless refinement of our knowledge which instils in the brain that function called mind □

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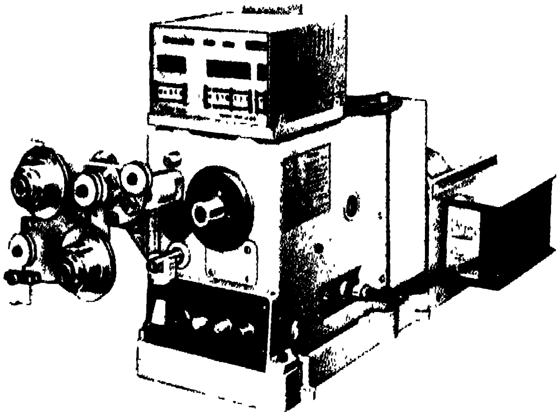

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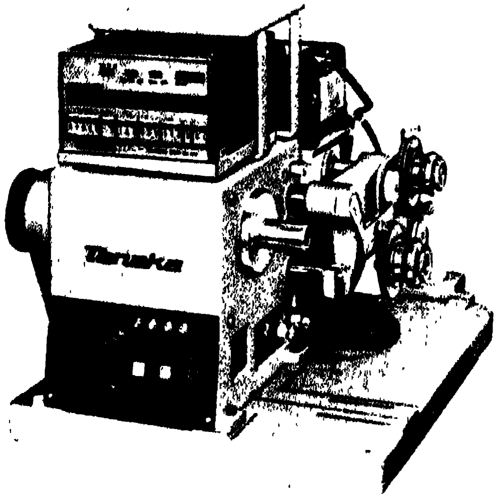

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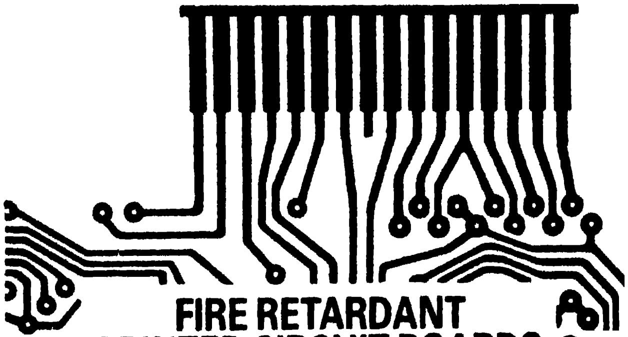

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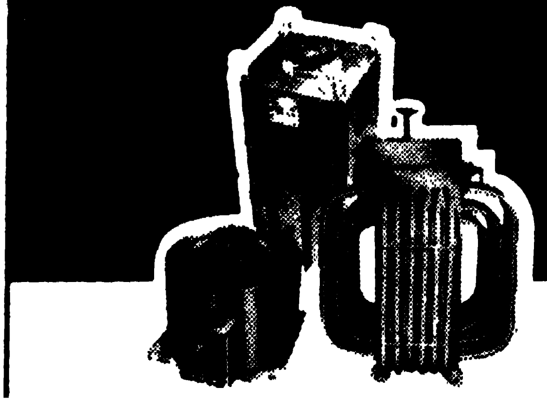

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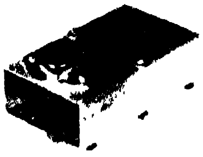

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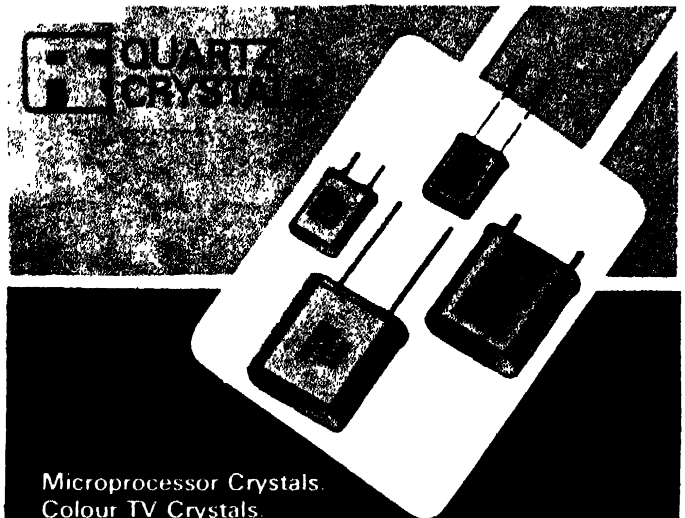

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Make Yourself This EPROM COPIER Using Microprocessor Kit

By M. Kathiresan

The 2716 (2K × 8) is an Erasable and Programmable Read Only Memory (EPROM) chip. Programming or copying is not a complicated procedure. For programming the chip, 25V supply is to be applied to pin 21 of the 2716 and 5V pulse of 5 ohms has to be applied to the programing pin 18. The IC 2716 operates from a single supply. So, it is ideal for use with microprocessor kits.

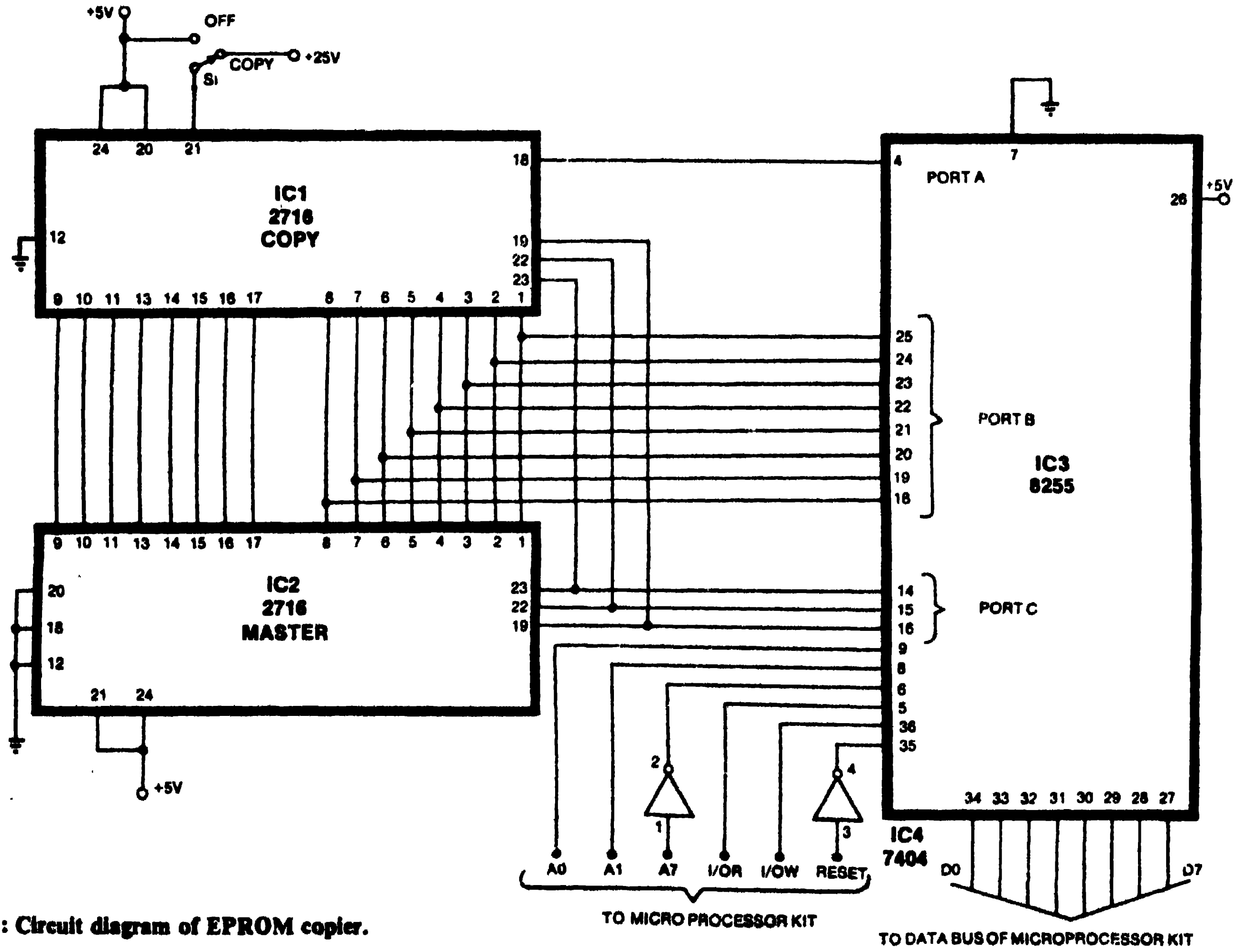

Fig. 1: Circuit diagram of EPROM copier.

The 8085 kit described earlier in a serial by Prof. K. Padmanabhan together with the interfacing circuit described here, can be used to copy all the data from all pages of master EPROM 2716 to the relevant pages of copy EPROM. Thus, one can conveniently copy all the programs from one EPROM onto another by using this circuit and the kit.

Circuit description

Two sockets are required, one for the EPROM being copied onto (marked as 'Copy EPROM') and one for the chip being copied from (marked as 'Master EPROM'). The data pins of both EPROMS are connected in parallel. The address locations of the both are connected to port B and port C of IC 8255.

The low address pins and high address pins are connected to port B and port C respectively. Pin 18 of copy EPROM is connected to port A of 8255. Pin 21 of copy EPROM is connected to +25V supply via the changeover switch S1.

The circuit incorporates programmable input/output IC 8255. Here, all the ports are used as output ports by outputting the control word 80 in the control register. After apply-

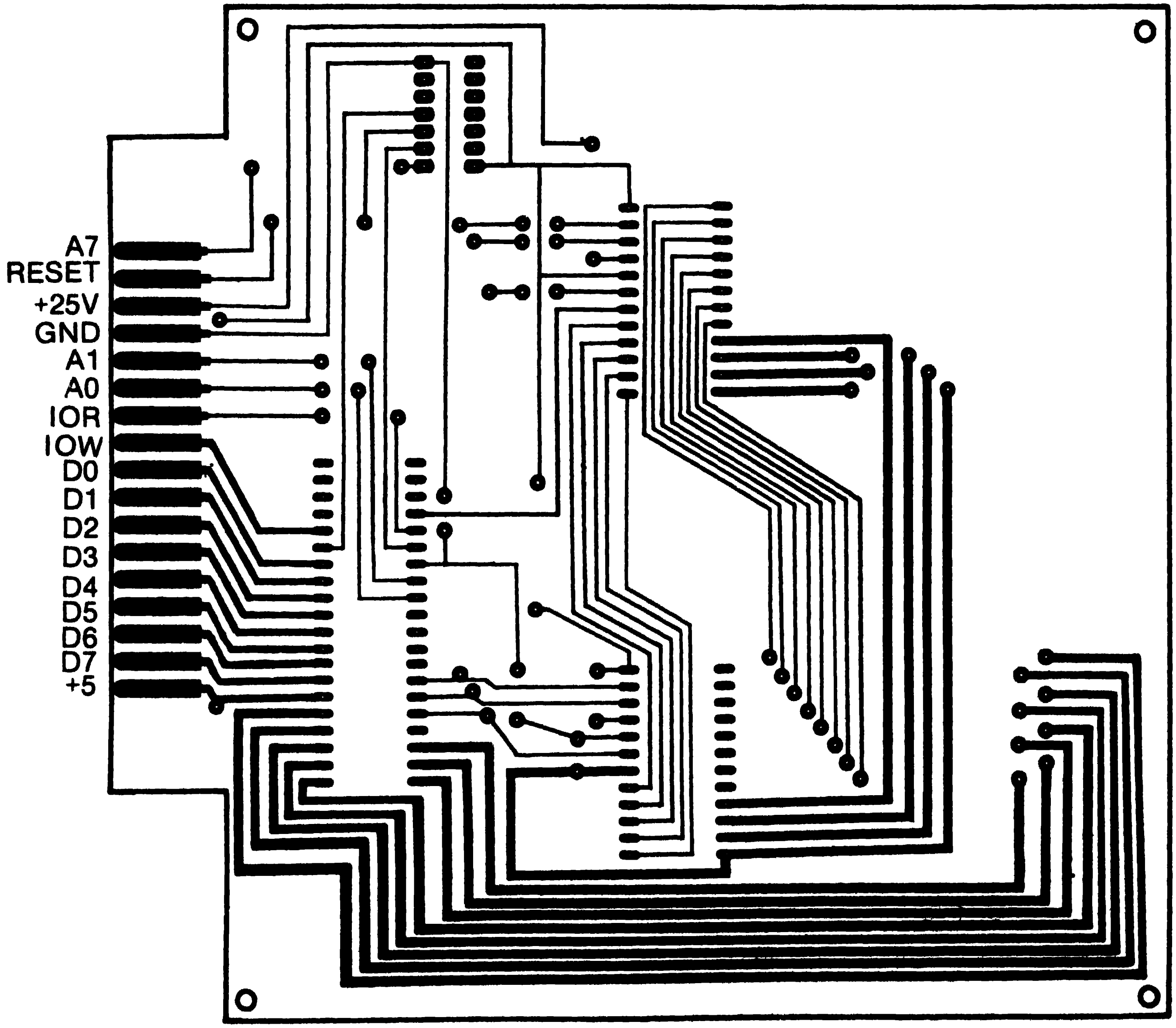

Fig. 2: Actual-size PCB layout for the EPROM copier.

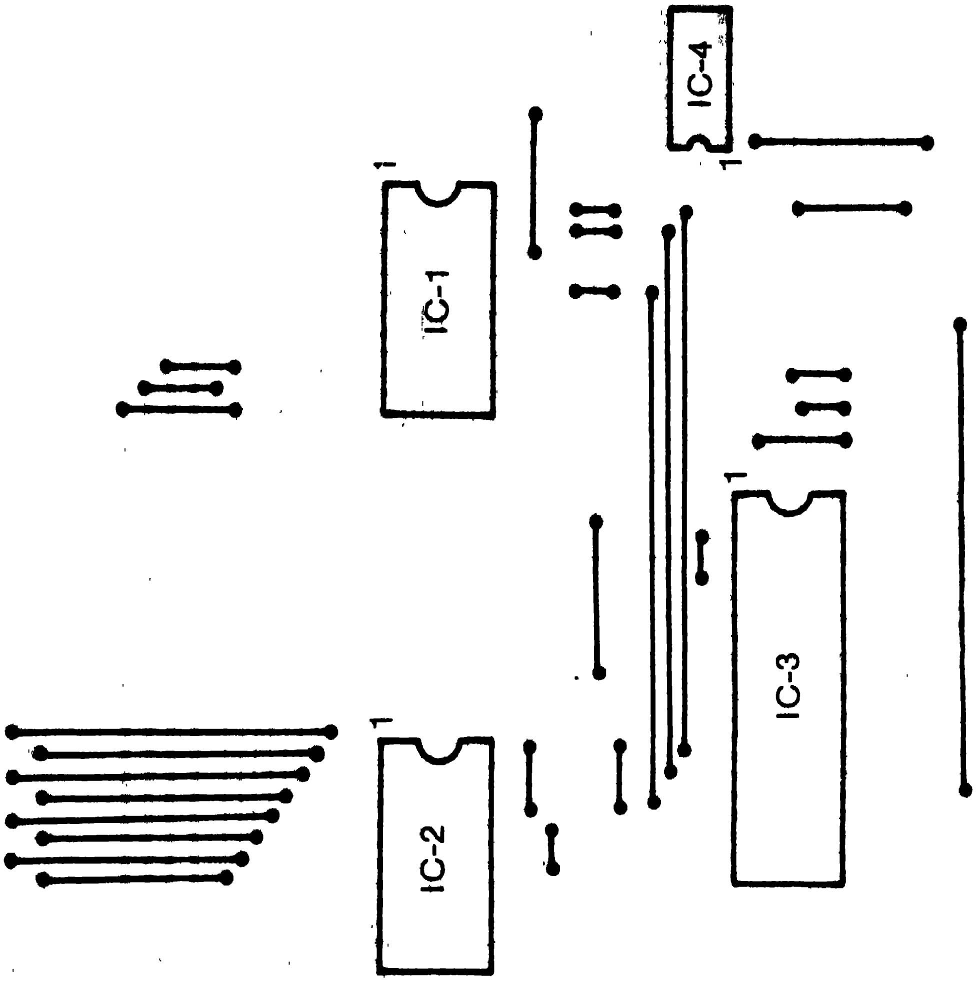

Fig. 3: Components layout for the PCB of EPROM copier.

ing the address to both EPROMs, the data from the master EPROM gets applied to the data inputs of a copy EPROM.

Now, programing pulse is applied to programing pin 18 of copy EPROM. The next address is then chosen and the data at that address gets applied to the copy EPROM.

Pulse is applied until the entire data in all pages is copied. This process is carried out according to the software listing given. The 50ms program pulse is also generated by the software.

On completion of copying of all pages, the display will show letter 'C', which indicates that copying is over.

The program starts from locations 10 00 to 10 3E. After inserting master EPROM and copy EPROM in the relevant sockets, apply +25V to pin 21 of copy EPROM 2716 through changeover switch S1.

Now, press the GO key of the kit, keeping H at 10 and L at 00, using HI and LOW keys. After copying is over, connect pin 21 of copy EPROM to 5V by means of changeover switch S1.

Details of software

The software program given here for use on RAM page 10 can also be permanently kept in the EPROM and used at will.

First, it sets H register to initial high address value and L register to low address value. Then program subroutine is called for copying and the low address and high address values are incremented. Program subroutine is then called again. This sequence continues till all the pages are copied.

The program subroutine outputs the high address value and low address value to the address inputs of both EPROMs via ports B and C of 8255. After setting up the address, 50ms pulse is applied via port A when it returns to the main program. After copying all data from all pages, the program executes the instruction at location 1018 for displaying letter 'C' in all displays.

The complete PCB pattern is given in Fig. 2. A ribbon cable can be used for connecting databus, the address lines A0, A1 and A7 and the I/OR and I/OW lines.

The +5V supply used in the kit would be enough for this board as well. A separate supply of 25V is used for pin 21 of copy EPROM. □

Software Program for EPROM Copier

Address	Mnemonic	Code	Comments
1000	MVID	16	Store 08 in the D register
1001	08	08	
1002	MVIA	3E	80 is code for 8255 for all ports
1003	80	80	to be output ports
1004	OUT	D3	Output this number to control
1005	83	83	register in the 8255
1006	LXIH	21	Load register pair H-L with
1007	FF	FF	H = FF, L = FF
1008	FF	FF	
1009 Pt A	INRH	24	Increase H by 1, now H = 00
100A	MVIE	1E	MOV 00 into F register
100B	00	00	
100C Pt B	INRL	2C	Increase L by 1, now L = 00
100D	CALL	CD	Call program subroutine for
100F	PROG	21	copying data in the relevant address
100F	SUBROUTINE	10	
1010	DCRE	1D	Decrement register E.
1011	JNZ	C2	Check whether all the locations
1012	Pt	0C	in a page are copied? If not, jump to point B
1013	B	10	
1014	DCRD	15	Otherwise, decrement D
1015	JNZ	C2	Check whether all the pages
1016	Pt	09	in the master are copied?
1017	A	10	If not, jump to point A.
1018	MVIA	3E	Move the data 72 into A register
1019	72	72	
101A	OUT	D3	Output this to port 2
101B	02	02	
101C	MVIA	3E	Move the data 00 into A register
101D	00	00	
101E	OUT	D3	Output this to port 1
101F	01	01	
1020	HALT	76	Halt, if necessary.
PROGRAM SUBROUTINE			
1021	MOVA, H	7C	Take high address value into A
1022	OUT	D3	Output this to port C of the 8255
1023	82	82	
1024	MOVA, L	7D	Take low address value into A
1025	OUT	D3	Output this to port B of the 8255
1026	81	81	
1027	MVI A	3E	Take data 01 into A register so
1028	01	01	that pin 18 goes high to give pulse
1029	OUT	D3	Output this to port A of the 8255
102A	80	80	
102B	CALL	CD	Calls the subroutine for 50ms delay
102C	TIME	33	
102D	DELAY	10	
102E	MVIA	3E	Take data 00 into A register so
102F	00	00	that pin 18 goes low after 50ms delay
1030	OUT	D3	Output this to port A of the 8255
1031	80	80	
1032	RET	C9	Return
TIME DELAY SUBROUTINE:			
1033	PUSH B	C5	Save registers
1034	LXIB	01	Set B-C to 11 FF
1035	FF	FF	
1036 Pt C	11	11	
1037	DCX B	0B	Decrement register pair B and C
1038	MOVA, B	78	Move it to A
1039	ORAC	B1	OR it with C
103A	JNZ	C2	Jump to point C if not zero
103B	Pt	37	
103C	C	10	
103D	POP B	C1	Restore registers
103E	RET	C9	Return

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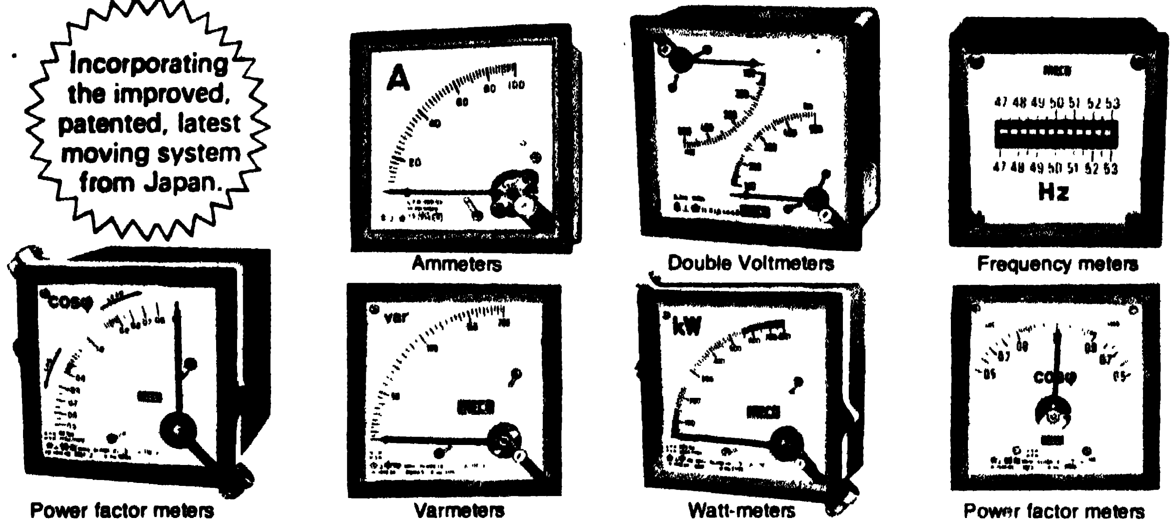

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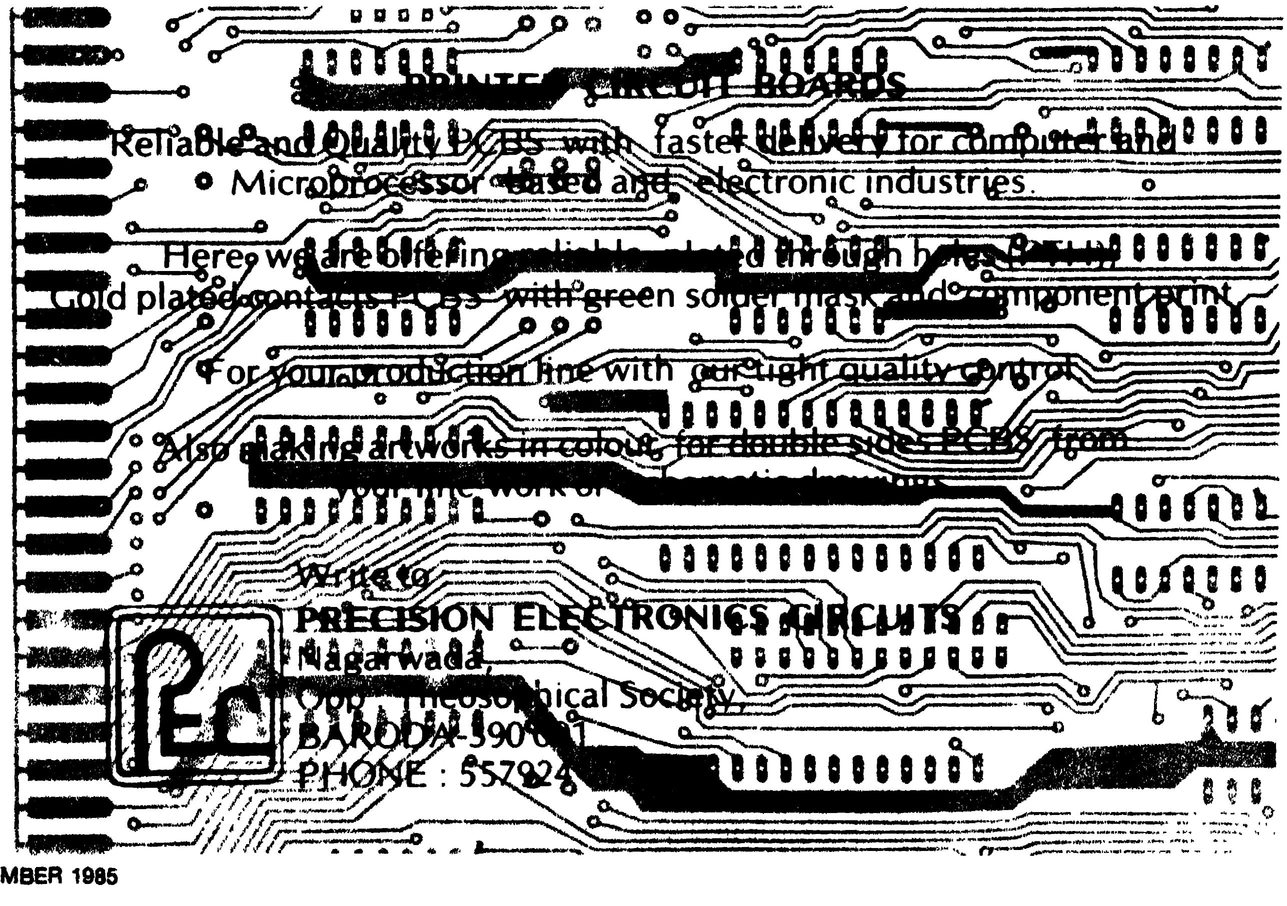

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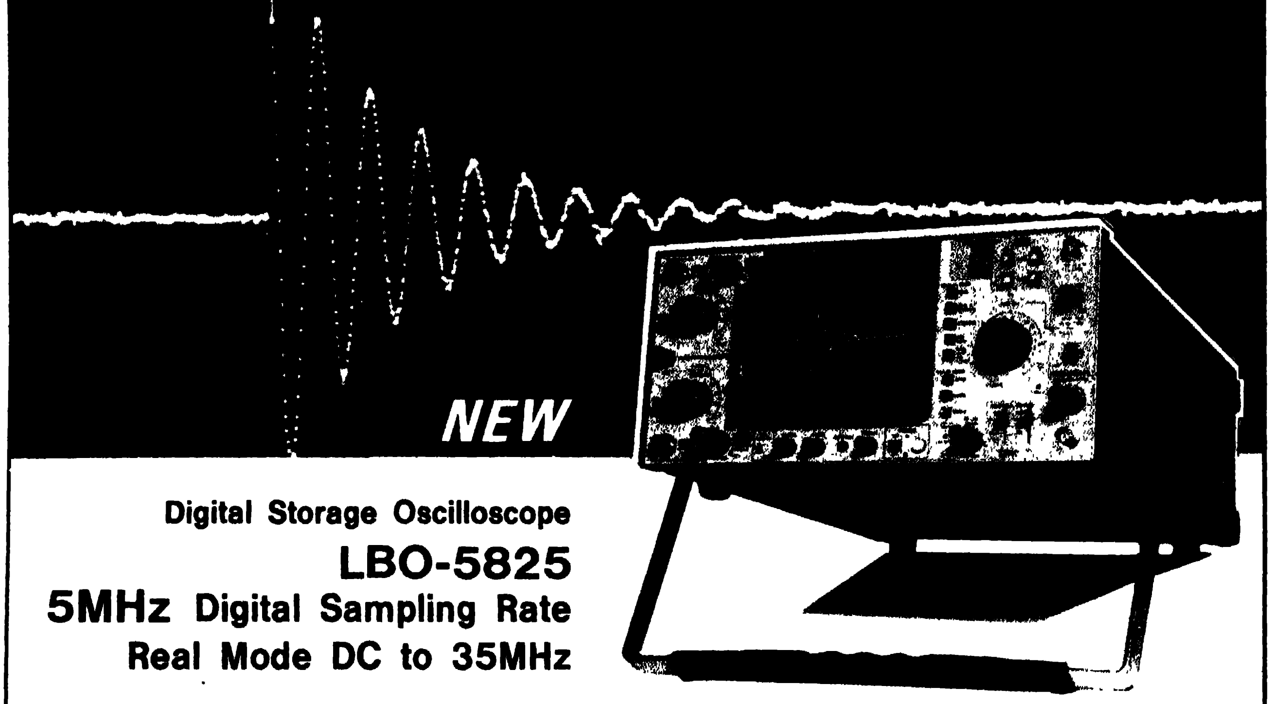

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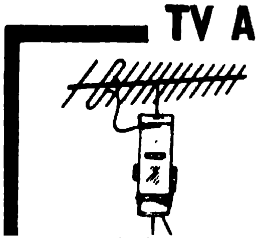

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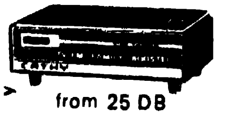

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CHEMTECH INDIA

Automatic Mast Light Switch

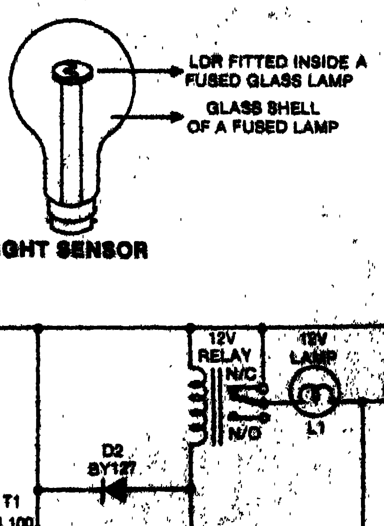
There are various ways of designing an automatic mast light switch, since several light sensitive devices are available in the market, such as LDR (light dependent resistor), photo diode, photo SCR and photo transistor etc. The circuit explained here makes use of LDR.

The 'dark' resistance of the LDR is very high and it reduces to a few ohms when light falls over it.

During day time, the voltage drop across LDR is very less and the voltage at point 'a' is high and hence transistor T1 remains in conduction. As long as T1 is conducting, T2 does not conduct and the relay in its collector circuit remains de-energised.

After sunset, as the light level starts falling, the voltage across LDR starts building up and the voltage at point 'a' starts falling. At a particular moment, depending upon the setting of the potentiometer VR1, T1 stops conduction and therefore T2 starts conducting, and hence relay RL1 in its collector circuit gets energised. This relay with its 'a2' contact actuates the contactor RL2 which switches on mast light. LED D2 gives an indication of 'mast light on' with 'a1' contact of the relay RL1.

Capacitor C2 delays the switching on and switching off operation of relay RL1 by few seconds. This delay is necessary in order to avoid the false operation of the mast light due to incidental interruption of light such as flying of a bird in the vicinity of the LDR sensor. Capacitor C2 also prevents the chattering of the relay near the threshold light level.


LDR FITTED INSIDE A FUSED GLASS LAMP
GLASS SHELL OF A FUSED LAMP

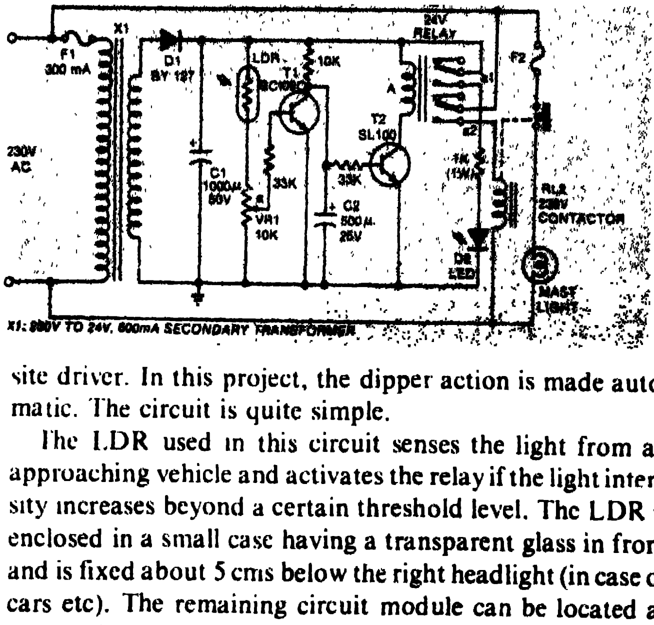
LIGHT SENSOR

LDR may be mounted in a fused ordinary light bulb, after removing the filament carefully from its inside. The LDR may be soldered directly to the filament leads, as shown in the figure, and the base can be fitted back in the glass shell using Araldite. This arrangement is very convenient to mount the sensor in a bulb holder, pointing towards sky. The replacement of the sensor, whenever necessary, also becomes very easy due to this arrangement.

K.A. SHAIKH

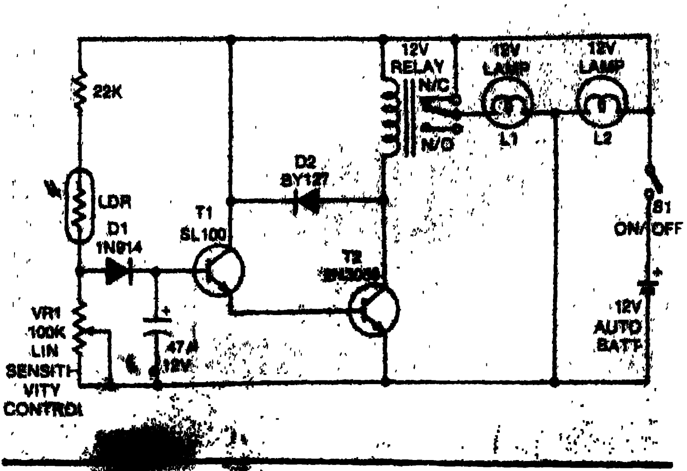
Electronic Auto Dipper

In this rapidly changing scientific world, everything is heading towards automation to relieve the human beings of some of the problems. Of late, many a gadget has been designed for the automobiles. This circuit controls the 'light dipper' action for driving at night.



When two vehicles approach each other, the drivers use mechanically operated dippers to avoid a glare to the opposite driver. In this project, the dipper action is made automatic. The circuit is quite simple.

The LDR used in this circuit senses the light from an approaching vehicle and activates the relay if the light intensity increases beyond a certain threshold level. The LDR is enclosed in a small case having a transparent glass in front and is fixed about 5 cms below the right headlight (in case of cars etc). The remaining circuit module can be located at some other suitable place.



The connections of head lamp and relay are shown in the circuit diagram. The relay used in the circuit has a 12V, 300mA coil, and is 'normally-closed' type. VR1 is the sensitivity controller.

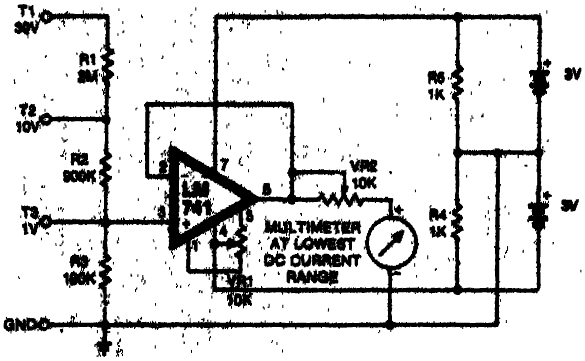
When the circuit is activated and the headlight beam is dipped, there will be a slight time delay before it returns to its 'normal' position. The delay has been introduced to give sufficient time for the opposite vehicle to pass through.

The circuit functions very well on highways, but within the city limits excess traffic and streetlight sources can cause unnecessary activation of the circuit. To avoid this the on-off switch is provided so that in city you may just switch off the unit.

HINDOCHA SHAILESH D.

Impedance Booster For Multimeters

Most low cost multimeters used by servicing technicians have moderate (4k/volt) input impedance. While this impedance may be adequate for some output measurements (where the source impedance is low), any serious troubleshooting requires a multimeter with higher input impedance. An input impedance of at least 20k/volt is required as most of the circuit drawings supplied by various manufacturers of entertainment equipment have voltages indicated which are measured with a 20k/volt instrument.



This circuit allows a low impedance meter to be converted to a higher impedance meter without altering the meter in any way. It has three ranges—30V, 10V and 1V—which are adequate for most purposes.

The circuit basically consists of a potential divider formed by resistors R1, R2 and R3 followed by a voltage follower circuit built around the low cost operational amplifier LM741 (metal case). The potential divider offers high input impedance to the signal voltages while voltage follower offers low output impedance to the meter.

Potentiometer VR1 helps in adjusting the output of the voltage follower to zero. This is done by shorting terminal T2 to ground and adjusting VR1 until the output of the op-amp (pin 6) shows zero volts to ground.

Potentiometer VR2 allows adjusting of the current through the meter. For this purpose the maximum rated voltage is applied to terminal 1 or terminal 2 (30V if terminal 1, 10V if terminal 2) and the voltage at the output (pin 6) of the op-amp measured. This voltage should be 1 volt. (For all the measurements the same meter that is to be converted can be used.) Then the meter, switched to its lowest DC current range, is connected between VR2 and ground, and VR2 is adjusted for full scale deflection of the meter.

R1, R2, and R3 should be 1% resistors, preferably of the metal film type and ½ watt capacity. R1 and R2 can be built up from smaller value 1% resistors (for example, R1 from two 1M resistors and R2 from nine 100k resistors in series). With the value of resistors shown, the input impedance is 100k/volt.

R4 and R5 form the voltage divider for obtaining the earth point when four battery cells are used for obtaining the ±3V.

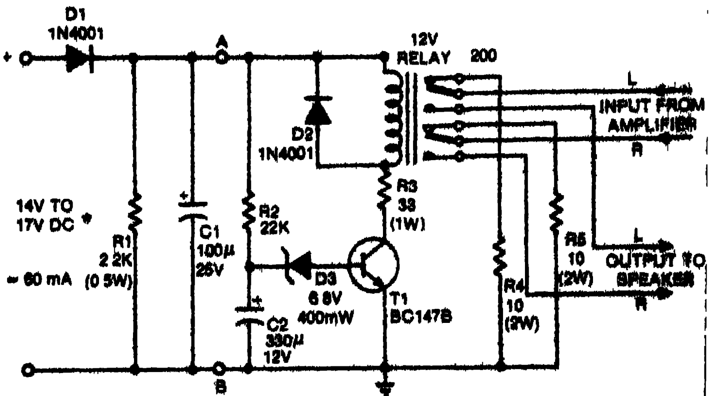
The circuit can be used for measuring DC voltages only.

S. SWETACHALAPATI RAO

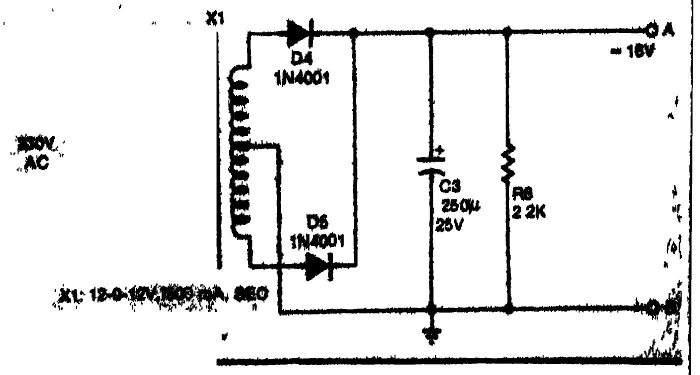
"De-Thump Circuit" For AF Amplifiers

Most amplifiers on being switched on, produce an annoying 'thump' sound. This is not only annoying but can also prove very damaging to the speakers.

This 'thumping' is caused by the momentary currents which are needed to charge the output capacitors and the initial instabilities in the circuit voltages. The first cause is non-existent in split supply circuits.



* FROM POWER SUPPLY OF EXISTING AMPLIFIER



The de-thump circuit given here uses a double pole relay to connect the speakers to the power amplifier circuit only after a period of about five seconds. Such a circuit is however found incorporated in some commercially available medium and high power amplifiers.

The circuit operates on a 14-17 volts DC supply, and has been designed with the split-supply TDA2020 power amp in mind—though this does not limit its use. With the above power amp, it can be connected directly to the positive supply and ground through a diode and condenser; otherwise a 12-0-12V, 150mA transformer with a full-wave rectifier can be used as shown in Fig. 2, and connected to points A and B in Fig. 1.

The circuit can also be connected to commercial amplifiers which do not possess the facility, but would have to be housed in a separate cabinet.

When the amplifier is switched on, capacitor C2 charges exponentially through resistor R2. In the mean time, the initial charging currents pass through resistors R4 and R5. When the voltage across the capacitor exceeds the zener voltage plus the cut-in voltage of the transistor, the transistor saturates, operating the relay and connecting the speakers to the amplifier circuit. With the given values of R2 and C2, a 5-second delay is produced. On switching off, capacitor C1 quickly discharges and the relay opens.

A 0.01μF (600V) capacitor should also be connected across the power on-off switch of the amplifier if not already present. And value of C2 may be increased to 470μF if a longer delay of 7.1 seconds is desired.

The circuit can easily be assembled on a general-purpose board, and should pose no problem to anyone who has already assembled an amplifier.

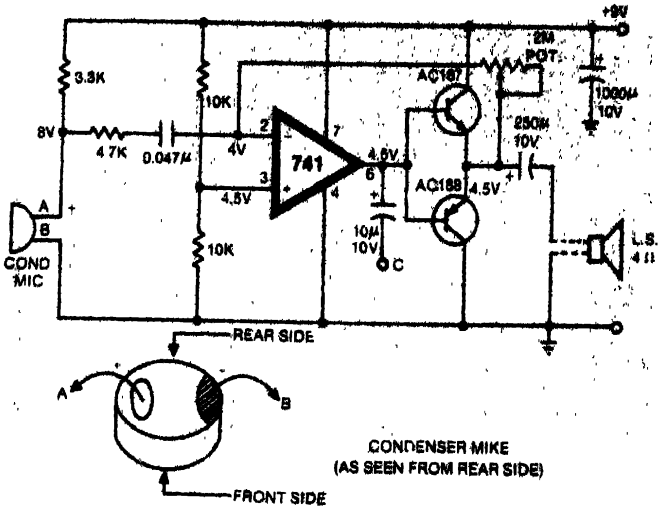
VIVEK MEHRA

Listening Bug

It is a simple, inexpensive and hi-fi device for listening to the conversation going on in an adjoining room or for the parents wishing to keep a strict vigil on the activities of their children through the sounds in childrens' rooms. It is one evening project for an experimenter.

The sound signals (even at a distance of 5 metres from the mike) are picked up by the condenser microphone, and converted into electrical variations which are amplified by the op-amp IC 741 used in the inverting mode with a single supply using divider network of resistors. The gain of IC 741 can be set by varying the feedback through 2.2M pot.

The output of IC 741 is further amplified by the push-pull amplifier using transistors AC187/AC188 pair. A shielded wire should be used to suppress hum for carrying the output signal from the output of the amplifier to speaker fitted in the other room. Alternatively, from point C onwards, the amplifier can be dispensed with by feeding the output of the IC 741 to the pick-up point of an ordinary transistor radio.



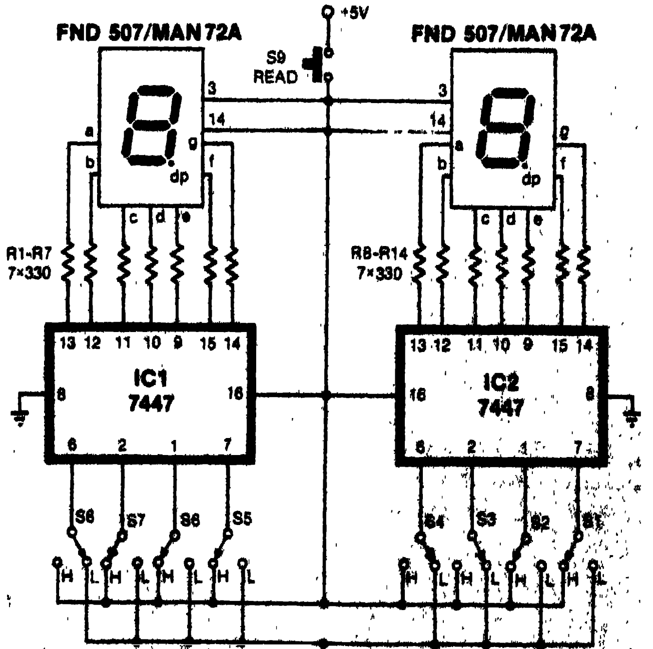
CONDENSER MIKE
(AS SEEN FROM REAR SIDE)

The condenser microphone may be housed in a proper enclosure to increase its sensitivity.

R.K. GUPTA

Mind Reader Using Digital Display

Think of a number between 1 and 99 .... toggle the switches in the groups wherever the number in your mind exists .... press READ switch, and there glows your number! Next time for your school science exhibition you can build this Mind Reader circuit. All you need is a couple of ICs, switches, etc and a suitable cabinet.



SWITCH POSITIONS SHOWN
ARE FOR DISPLAYING '73'

The mind reader works on binary number system, which uses only symbols '0' and '1' (known as bits) to form a number. To encode decimal numbers in BCD format, four binary bits are required. The BCD format is also called

NBCD because of the natural binary number system that it uses.

8 9 18 19 28 29
38 39 48 49 58 59
68 69 78 79 88 89
98 99

S4

4 5 6 7 14 15 16 17
24 25 26 27 34 35
36 37 44 45 46 47
54 55 56 57 64 65
66 67 74 75 76 77
84 85 86 87 94 95
96 97

S3

2 3 6 7 12 13 16 17
22 23 26 27 32 33
36 37 42 43 46 47
52 53 56 57 62 63
66 67 72 73 76 77
82 83 86 87 92 93
96 97

1 3 5 7 9 11 13 15
17 19 21 23 25 27
29 31 33 35 37 39
41 43 45 47 49 51
53 55 57 59 61 63
65 67 69 71 73 75
77 79 81 83 85 87
89 91 93 95 97 99

S1

1 2 3 4 5 6 7 8 9
80 81 82 83 84 85
86 87 88 89 90 91
92 93 94 95 96 97
98 99

1 2 3 4 5 6 7 8 9
40 41 42 43 44 45
46 47 48 49 50 51
52 53 54 55 56 57
58 59 60 61 [illegible] 63
64 65 66 67 [illegible] 69
70 71 72 73 74 75
76 77 78 79

S7

1 2 3 4 5 6 7 8 9
20 21 22 23 24 25
26 27 28 29 30 31
32 33 34 35 36 37
38 39 60 61 62 63
64 65 66 67 68 69
70 71 72 73 74 75
76 77 78 79

S6

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15
16 17 18 19 30 31
[illegible] 33 34 35 36 37
[illegible] 39 50 51 52 53
54 55 56 57 58 59
70 71 72 73 74 75
76 77 78 79 90 91
92 93 94 95 96 97
98 99

S5

A 2-digit decimal number, say 89, can be expressed as 1000 1001 in BCD digit group. Here 1000 denotes 8 in the tens place and 1001 denotes 9 in units place. By toggling the switches in the different sets of numbers either 1 or 0 is generated, depending on whether the number exists in the group or not. Eight switches designated S1 to S8 are arranged in order from right to left in the BCD code. The number 89 exists in S1 and S4 groups for the units digit giving 9 and in S8 group for tens digit giving 8. Similarly, 73 represented as 0111 0011, will appear in the groups S1, S2, S5, S6 and S7.

The circuit can be hooked up as shown in the diagram. Any common anode type 7-segment display may be used. For arranging the numbers in groups, each digit in the tens and units place is first expressed in binary code. Now starting from the right to left at each place where 1 appears the number should be written in the corresponding group. That is, it will generate the same code required to represent the number by toggling the switches.

However, you will find that all the single digit numbers, viz, 1 to 9 also appear in the groups S5 to S8. This is done to keep the display blank in the tens place, should one think of a single digit number.

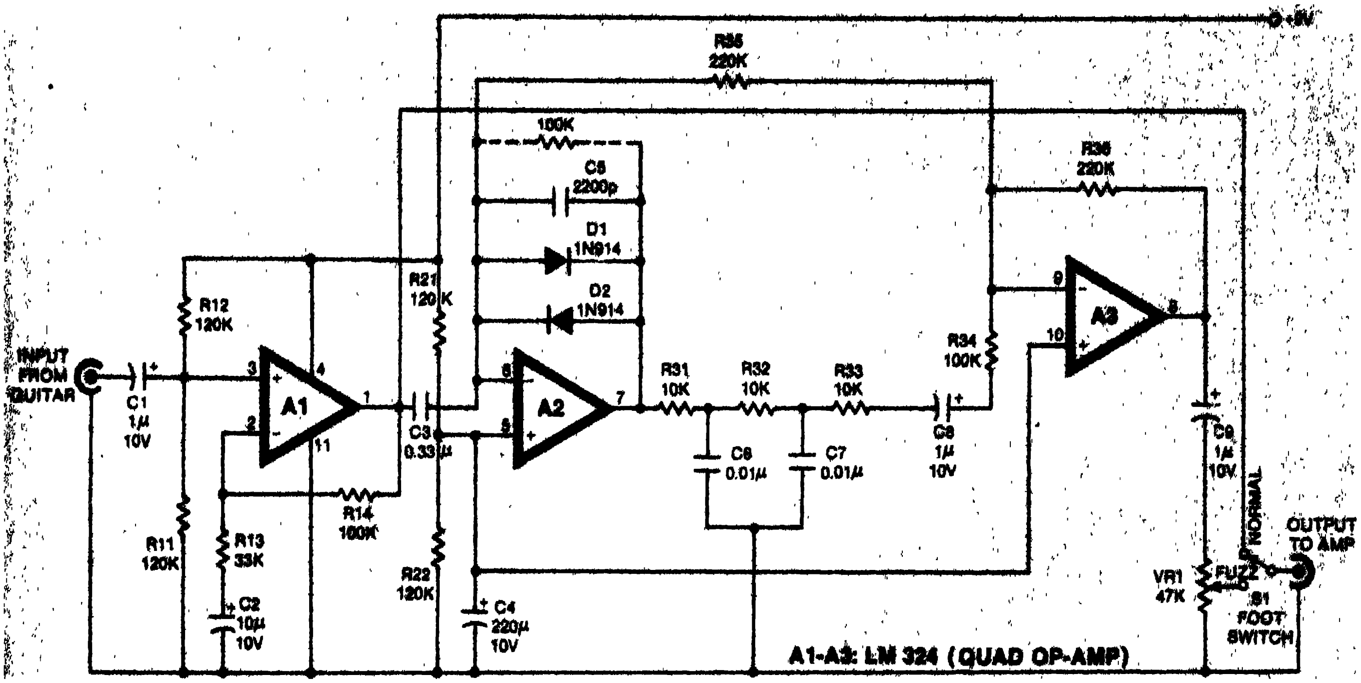
The whole thing may be enclosed in a suitable cabinet. It will give you hours of fun in the next science exhibition.

K. BARUA

IC Fuzz For Guitar

Here is another addition to my series of circuit ideas on electronics music novelties, an IC Fuzz unit for guitar. The unit gives a snaring fuzz along with a good sustaining effect, using a single IC (LM324).

Fuzz effect is produced basically by distorting the signal from the guitar pick-up and mixing it with undistorted signal to the desired level.



The op-amp A1 is rigged as a non-inverting amplifier, which amplifies the guitar pick-up signal. The signal is then fed to op-amp A2 which has two silicon diodes in the feedback path to produce distorted sound. The 2200pF capacitor (C5) is put across diodes D1 and D2 to remove the noise.

The output of A2 is filtered using the RC filter and fed to op-amp A3 which is connected as a mixer. Here the amplified guitar signal as well as the distorted signal are mixed at proper levels to produce the required fuzz effect.

Those who want only a mild fuzz effect can use a 100k resistor across the diodes D1 and D2. There is lot of scope for experimentation by decreasing R13 or by increasing R14.

This circuit has been tested with the amplifier circuit (Solidstate Guitar Practice Amplifier) and is giving good results. The footswitch S1 is used to switch the guitar in and out of fuzz circuit. The VR1 is set to such a level that when the unit is switched in and out there is no change in the overall volume.

S.A. SRINIVASA MOORTHY

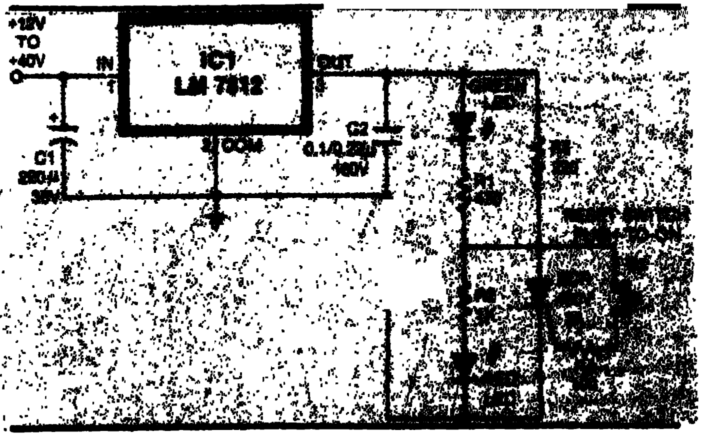
Power Failure Indicator

There are several circuits for power failure indication built around 741 op-amps, logic gates etc. Most circuits using the 741 op-amp suffer from DC offset problems. The circuits which make use of logic gates are very reliable but the wiring and construction are slightly complicated. Besides these, a PCB with IC holding provision must be procured.

These above mentioned problems can be eliminated by our innovative circuit. This novel type of indicator incorporating a silicon controlled rectifier (SCR) as the only static switching element, is functioning very well for many months in our science centre office. An SCR with high voltage rating is used here to minimise any possibility of spurious triggering.

The mode of operation of this circuit is very simple and this simplicity is a positive factor in improving the reliability of the same.

When the power is switched on for the first time, the red LED glows because the SCR remains off, owing to lack of gate trigger. Now if the pushbutton switch is pressed momentarily, the SCR receives the required gate trigger pulse through the current limiting resistor R4. Thus the SCR is turned on. Due to the self-latching property of a four layer semiconductor diode, the SCR continues to conduct current even when the gate drive is removed.



Now for obvious reasons, the red LED goes off. The green LED begins to glow because it gets the required supply by the voltage drop developed across R3 during the conductive state of the SCR. The whole picture described above is held alive indefinitely, as long as the power remains available.

Now suppose load shedding or other type of power failure comes about. It is evident that once the power failure takes place, the whole picture in the latched position of the SCR will be upset. Once the anode supply of the SCR is interrupted for a brief interval, the SCR remains non-conductive even when the supply is restored. Thus on restoration of the power, the SCR is pulled back immediately to the first phase (red LED glowing). This mechanism 'remembers' the event of power failure. The circuit can be reset by pressing the pushbutton again as before.

The voltage regulator IC 7812 can be omitted if a reasonably spike free, steady voltage is available. (A zener diode stabiliser may be used.)

A spike free, stable power source should be provided to eliminate the false (dv/dt) triggering of the SCR, and also for ensuring the protection of the LEDs.

The unit should cost around Rs 20 without the power supply.

Total current drain during the power on period is about 60 mA.

BOYS OF ELECTRONICS SECTION,
HINDU SCHOOL SCIENCE CENTRE,
CALCUTTA

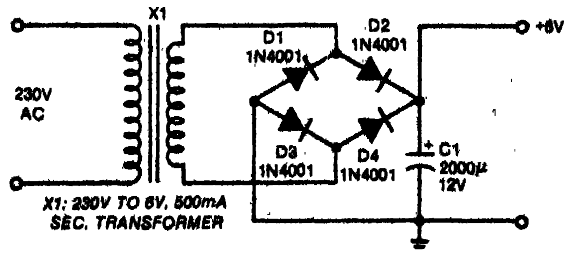
SPECIAL FEATURE

Electronic In/Out Indicator

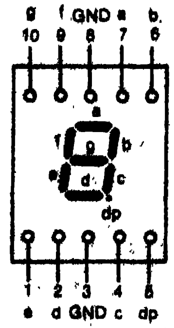
Most of us are familiar with in/out indicators near letter boxes in our houses which indicate whether or not the person concerned is at home. They are normally made up of wood. But now in this age of electronics, won't it be better to use electronic in/out indicators? Here is a very simple circuit that can perform this task by displaying the information on three common-cathode 7-segment displays.

When the SPST switch S1 is open, it indicates the 'in' state, and the AC127 transistor is turned on. When S1 is closed, indicating the 'out' state, the 2N2907 transistor is turned on. The corresponding segments are lit in the two cases. Let us now examine how the segments are connected.

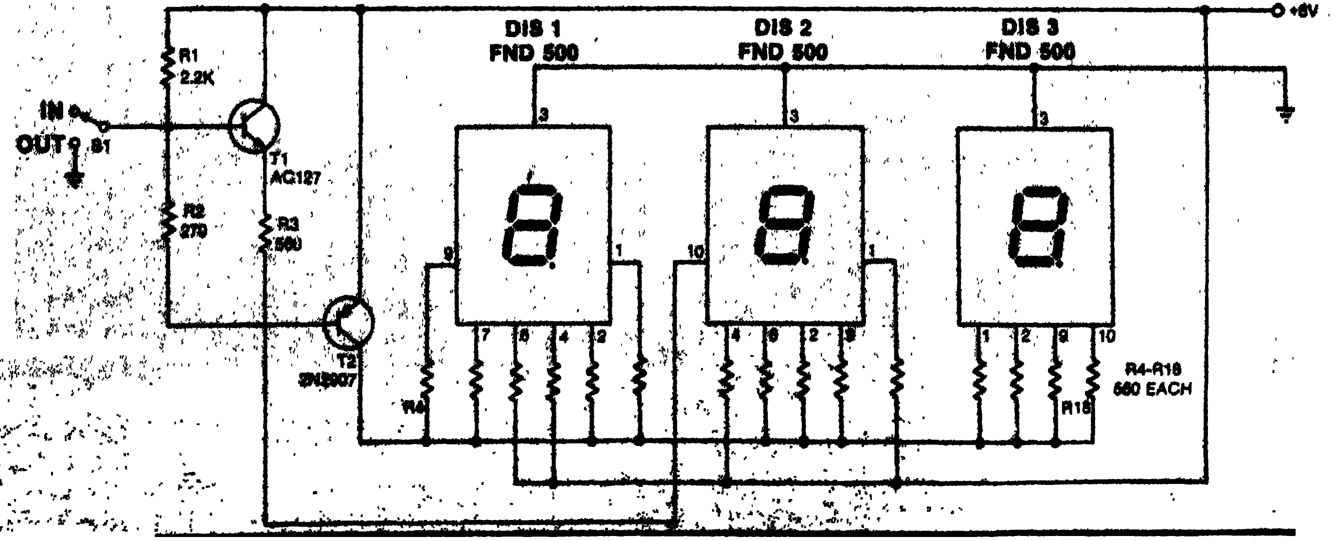
If we want to display the in or out information, we note that the b and c segments of the first display (DIS1), and the c and e segments of the second display (DIS2) must always glow. So they are connected directly to the supply via current-limiting resistors. To display 'in', the only other segment that must be lit is segment g of DIS2. So this segment is activated by the AC127. Similarly, to display 'out', the other segments that must be lit are a,d,e,f of DIS1; b,d,f of DIS2, and d,e,f,g of DIS3. All these segments are



6V DC POWER SUPPLY



PIN CONFIGURATION OF FND 500



activated by the 2N2907.

The circuit is powered by a 6V DC source, which can be conveniently built, as shown.

INDRANIL SEN GUPTA

Call Bell With Memory

This project does not cost much at Rs 90, and young enthusiasts would find it quite interesting. It also does not go fully into electronics but involves only the basics of the field.

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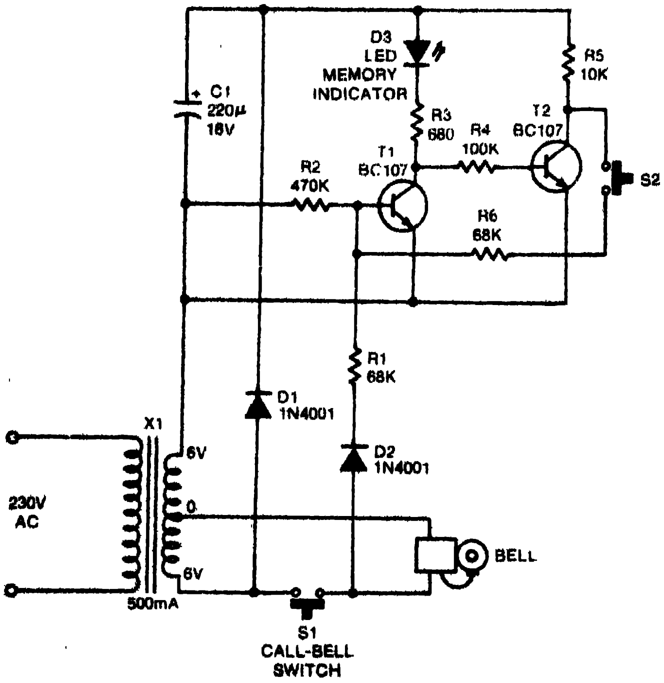

If you are going out, you can press switch S2 and on returning if you find the LED is on, it means that someone had come while you were away.

S1 is an ordinary bell switch. S2 can be set as many times as desired by simply depressing it.

AMRISH KUMAR

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ADJUSTABLE VOLTAGE POWER SUPPLY USING LM317

It is difficult to use adjustable voltage three terminal regulators in constructing wide range adjustable voltage power supplies because in these regulators the maximum available output current is determined by the output voltage setting. With the LM317, for instance, if adequate heatsinking is provided, for a 5-volt input-output voltage differential the internal current limiting circuitry limits the output current to 2.2 amps. However, since the device is provided with safe area protection, which limits the maximum power dissipation of the package to 15 watts, the available output current falls with increasing input-output voltage differential. At a 25-volt input-output voltage differential, the safe area protection circuit limits output current to about 600 mA only.

This dependence of output current rating on output voltage setting is undesirable, for it not only makes the power supply inconvenient to use but also unnecessarily bulky and expensive. To survive an overload under a condition of low input-output voltage differential, the transformer and rectifiers would have to be rated for at least 1.5 amps. On the other hand, these components would not be effectively utilised when the power supply is set to deliver a low output voltage (and is hence operating under a large differential).

The output voltage of the power supply circuits described in this article is variable from 1.25 volts to 25 volts and the maximum output current remains fixed, irrespective of output voltage setting. In addition, circuits delivering an output current in excess of 1.5 amps (the maximum output current rating of the LM317 used by itself) are also described.

A basic adjustable voltage regulated power supply circuit using the LM317, such as that shown in Fig. 1, as well as a brief explanation of the working of the LM317 has already been given in an earlier issue of Electronics For You (EFY, Dec. 1984). The LM317 is a complete regulator having internal feedback, regulating and current passing elements and incorporating various types of protection circuits such as current limit (which limits short circuit current to about 2.2 amps), safe area protection (which limits package power dissipation to 15W for the TO-220 package and 20W for the TO-3 package), and thermal shutdown (to limit junction temperature T_j to about 150°C).

In operation, the LM317 develops an accurate reference voltage, typically 1.25 volts, between its output (OUT) and adjustment (ADJ) terminals. This reference voltage when

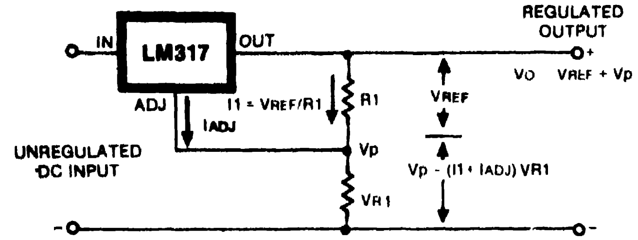


Fig. 1: Basic regulator circuit using LM317.

impressed across the program resistor R1 sets up a current $I1 = V_{REF}/R1$ in R1. I1 along with the quiescent current I_{ADJ} from the adjustment terminal of the IC flows in the output voltage set resistor VR1 (usually a potentiometer), so that the voltage V_p developed across VR1 is $V_p = (I1 + I_{ADJ})\,VR1$. The output voltage V_o at the output of the regulator is hence $V_o = V_p + V_{REF}$ given by

$$V_o = V_{REF}\left(1 + \frac{VR1}{R1}\right) + I_{ADJ}.\,VR1$$

The LM317 is designed to minimise I_{ADJ} and also to make I_{ADJ} independent of line and load changes. To achieve this, all the quiescent current is returned to the output terminal, thus establishing a minimum load current requirement. Typically, $I_{ADJ} = 50\mu A$ and $\Delta I_{ADJ} = 0.2\mu A$. The typical minimum load current requirement is 3.5 mA, but in some devices it may be as high as 10 mA.

By selecting R1 = 100 ohms, I equals 12.5 mA, and the condition of minimum load current is met. Also, since $I1 \gg I_{ADJ}$, the expression for output voltage simplifies to

$$V_o = V_{REF}\left(1 + \frac{VR1}{R1}\right)$$

As explained previously, the output current in a simple circuit such as this is dependent on the output voltage setting. With increasing input-output voltage differential, the maximum available output current reduces since the safe area protection circuit within the IC limits package power dissipation.

In Fig. 2, transistor T1 alongwith current limit resistor R_{SC} limits the maximum output current to 0.5 amp, regardless of output voltage. Should the output current begin to exceed 0.5.amp, the voltage developed across Rsc will be sufficient to turn on T1 which then shunts VR1, thereby reducing output voltage to the extent necessary to maintain the output current within the 0.5 amp limit. Under output short circuit conditions, the safe area protection circuit within the IC will itself limit the output current to 0.5 amps as the device would then be operating under an input-output voltage differential of almost 30 volts.

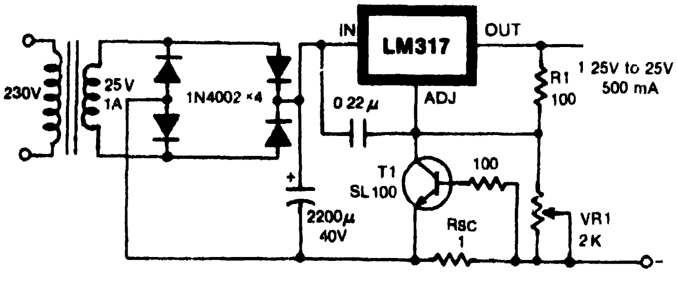


Fig. 2: 1.25V to 25V, 500mA regulated power supply using LM317.

When the LM317 is used in a circuit such as that shown in Fig. 2, the maximum output current is limited to about 0.5 amp only. The maximum output current can however be raised if required by the addition of an outboard series-pass transistor as shown in Fig. 3 where an external pnp booster transistor is used to raise the output current rating to 1.5 amps.

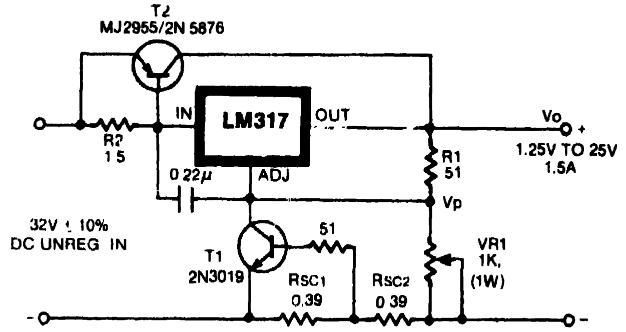


Fig. 3: 1.25V to 25V, 1.3-amp adjustable voltage regulator using pnp external booster transistors.

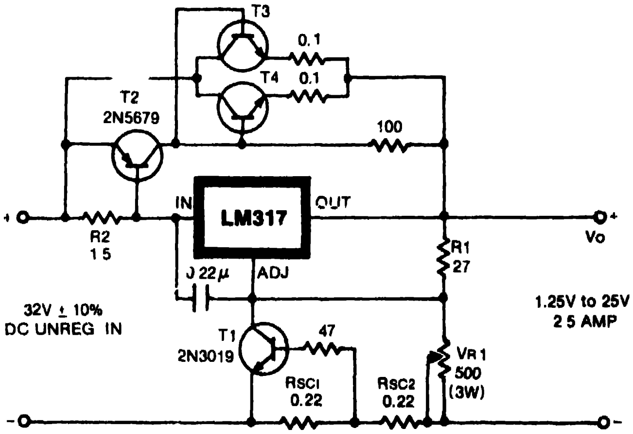


Fig. 4: 1.25V to 25V, 2.5-amp adjustable voltage regulator using npn external booster transistors.

At low output currents (< 0.4 amp), the voltage developed across R2 is insufficient to bring the external current booster transistor T2 into conduction and the entire output current is obtained via the regulator IC alone. When the output current exceeds 0.4 amp, the voltage developed across R2 is sufficient to bring T2 into conduction and the output current is then derived via the regulator IC as well as the booster T2. R_{SC1} along with T1 limits the output current to about 1.6 amps. As the output current approaches 1.6

Fig. 5: Actual-size common PCB layout for all the circuits.

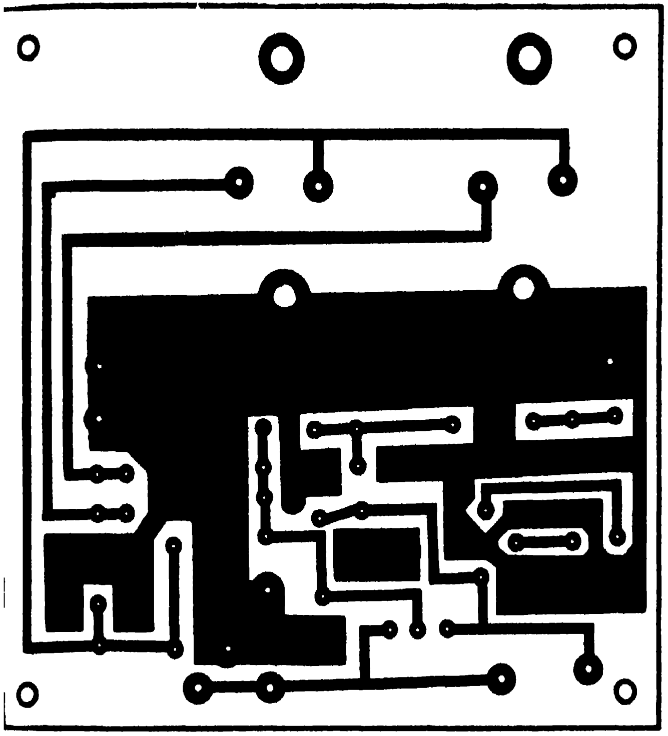
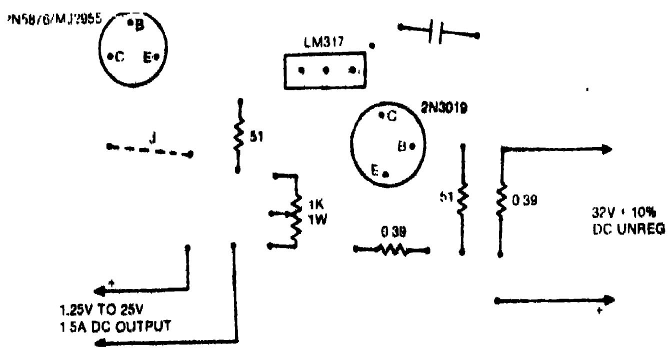


Fig. 7: Components layout for circuit in Fig. 3.



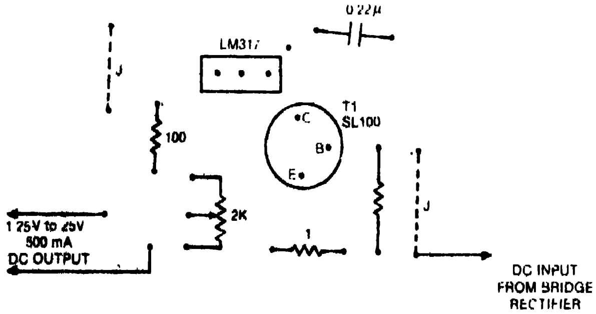


Fig. 6: Components layout for circuit in Fig. 2.

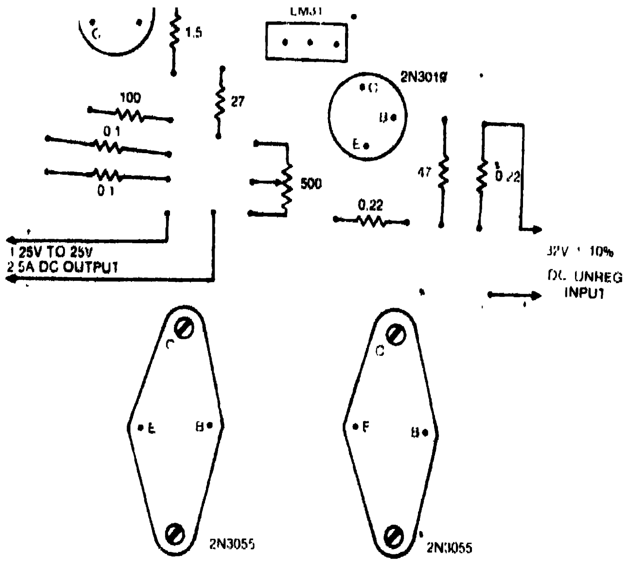
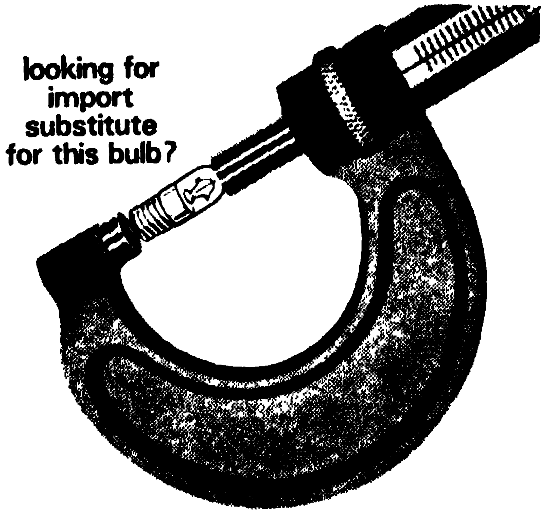


Fig. 8: Components layout for circuit in Fig. 4.

amps, the voltage drop across R_{SC1} brings T1 into conduction and it shunts V_R, thereby reducing the output voltage so that the output current remains within the 1.6 amp limit.

Should a short circuit occur across the output, T1 is driven hard into saturation and its collector potential falls to about 0.2V (relative to its emitter terminal). At this time the output voltage is $V_O = V_P + V_{REF} = 1.45V$. Hence the short circuit current is limited to $I_{SC} = 1.45V/(R_{SC1} + R_{SC2})$. With component values as shown, this works out to approx 1.9 amps.

For higher output currents, a number of pnp power transistors, each with a series emitter resistor, may be connected in parallel and used in place of T2 as the external series-pass element. However, at high output currents (> 2 amps), better load regulation is achieved with the circuit shown in Fig. 4. Since high power pnp transistors are both expensive and difficult to obtain, the circuit in Fig. 4, which makes use of readily available and inexpensive npn power transistors, works out cheaper, although it makes use of one extra transistor. ☐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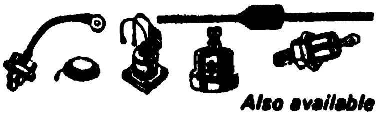

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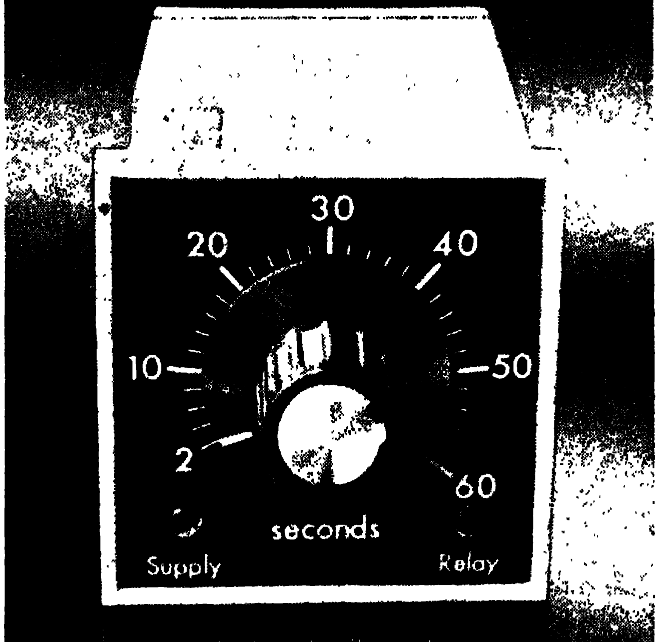

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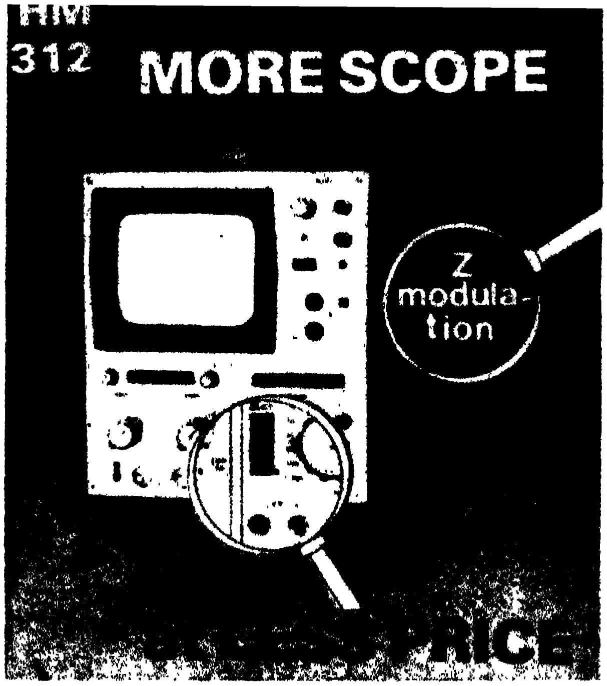

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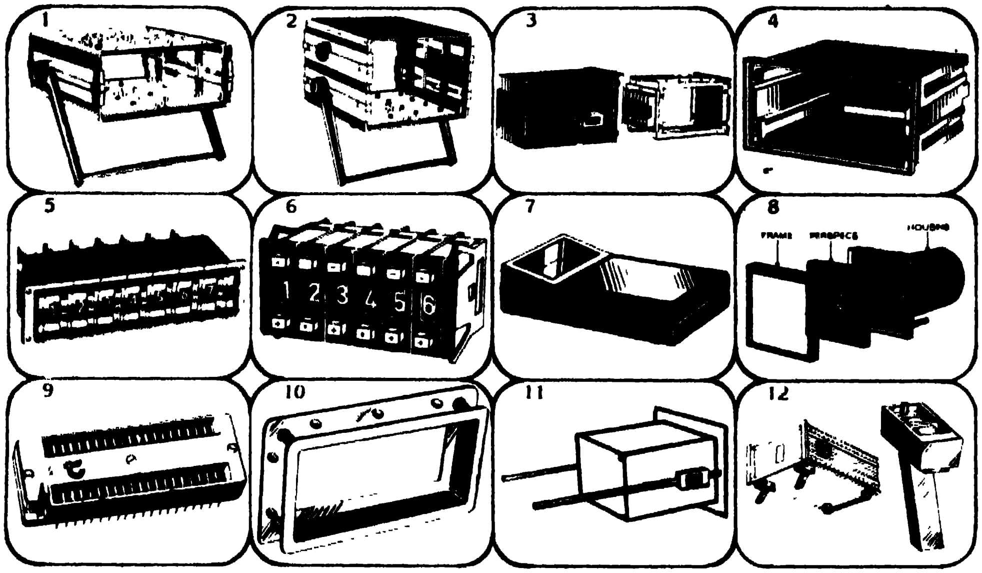

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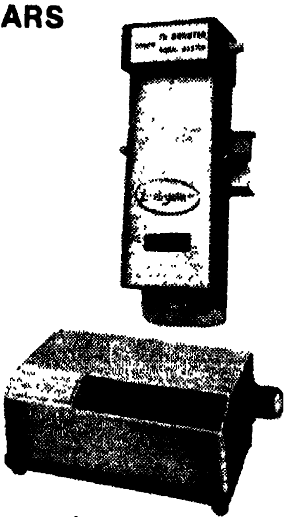

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M ERATURE CONTROLLER

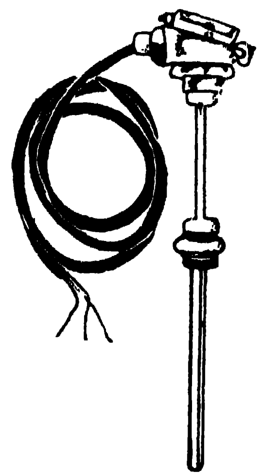
Resistance temperature detectors (RTDs), thermistors, solidstate devices and thermocouples are well known as temperature sensing elements. RTDs give linear output and offer temperature range of -220° to 550°C, whereas thermocouples are non-linear in character and they need cold junction compensation in measurement circuit. Their output is too low compared to RTDs which are excited externally to get proper output. Thermocouples are available in various ranges and are particularly useful for higher range of temperature, i.e. from -200°C to about 2500°C. Recently, ceramic style protection tube and ceramic fibre in place of asbestos insulation has improved thermocouples' temperature capability and resistance to corrosive environment.

In this article, use of temperature sensing elements, such as RTDs and TCs in temperature controller, has been discussed and design of temperature controller with defined band of temperature has been explained. These controllers have many diverse applications such as motorised valve, motor actuator, magnetic valve etc in the process control applications and in heating and airconditioning circuits. These controllers are found to give a control accuracy of 0.25% to 0.5% of FSD.

Principle of temperature controller

Popularly known as PT-100, a platinum resistance bulb is used as one arm of the wheatstone bridge as sensing element. Its calibration characteristics are shown in Fig. 1. This bridge when connected to 100-ohm resistance and excited by 5V DC source, would give an output proportional to the ambient temperature. This is amplified by an op-amp and fed to a voltmeter which has been calibrated for measurement purposes.

Theoretically obtained voltage V_{ab} from bridge can be



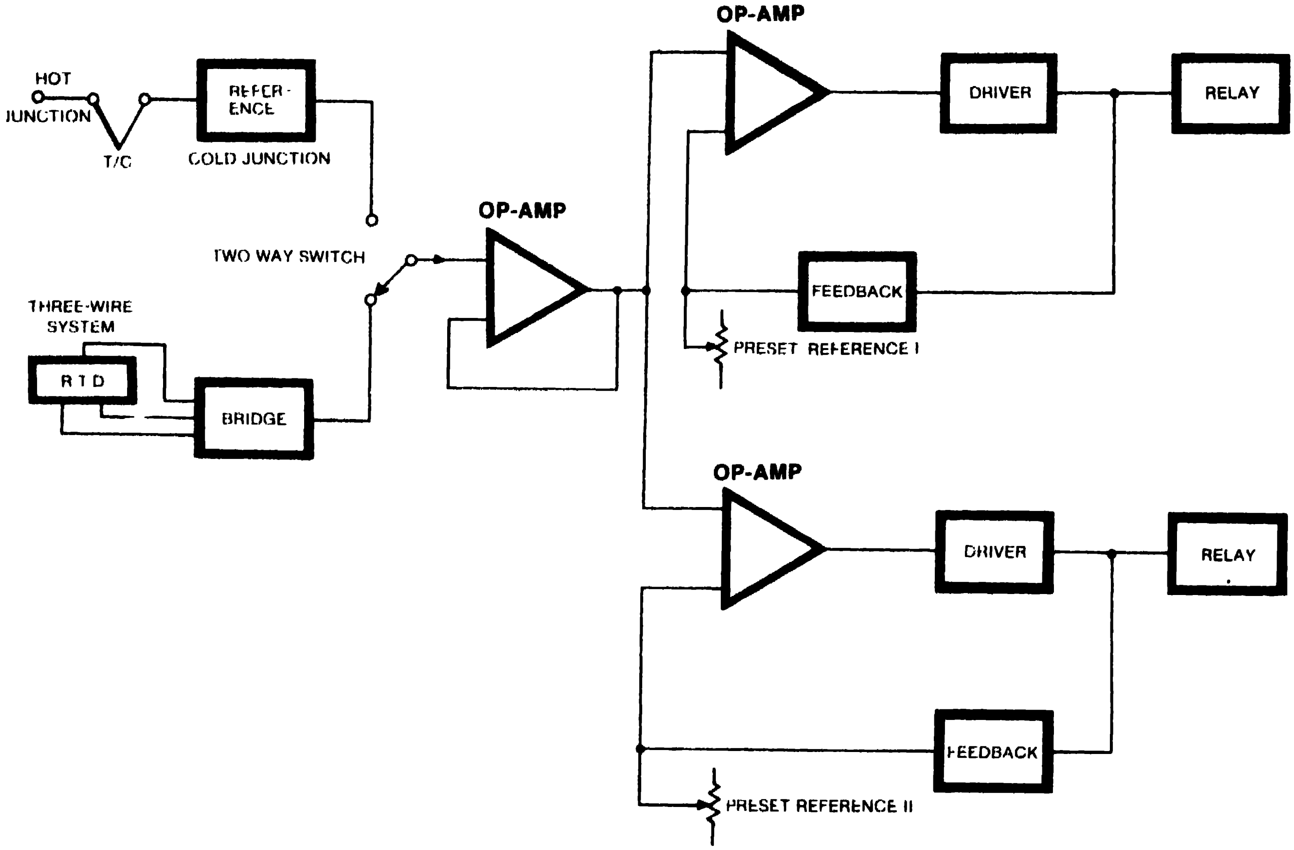
Characteristics for Platinum Resistance Bulbs (to DIN 43760)
(Tolerance from characteristics approx. ±0.3%)

°C	ohms	°C	ohms	°C	ohms	°C	ohms	°C	ohms
-220	10.40	-60	76.28	+90	134.70	+240	190.46	+380	240.16
-200	18.53	-50	80.25	100	138.50	250	194.08	390	243.61
-190	22.78	-40	84.21	110	142.28	260	197.70	400	247.06
-180	27.05	-30	88.17	120	146.06	270	201.30	410	250.50
-170	31.28	-20	92.13	130	149.82	280	204.88	420	253.93
-160	35.48	-10	96.07	140	153.57	290	208.46	430	257.34
-150	39.65	0	100.00	150	157.32	300	212.03	440	260.75
-140	43.80	+10	103.90	160	161.04	310	215.58	450	264.14
-130	47.93	20	107.79	170	164.76	320	219.13	460	267.52
-120	52.04	30	111.67	180	168.47	330	222.66	470	270.89
-110	56.13	40	115.54	190	172.16	340	226.18	480	274.25
-100	60.20	50	119.40	200	175.84	350	229.69	490	277.60
- 90	64.25	60	123.24	210	179.51	360	233.19	500	280.93
- 80	68.28	70	127.07	220	183.17	370	236.67	550	297.43
- 70	72.29	80	130.89	230	186.82				

Fig. 1: Calibration chart for PT-100.

Mr Krishna Gopal is Scientist 'C' in the Research & Development Estt (Engineers) of the government of India's (Ministry of Defence) Research & Development Organisation at Pune.

Fig. 2: Block diagram for two set-point comparator.



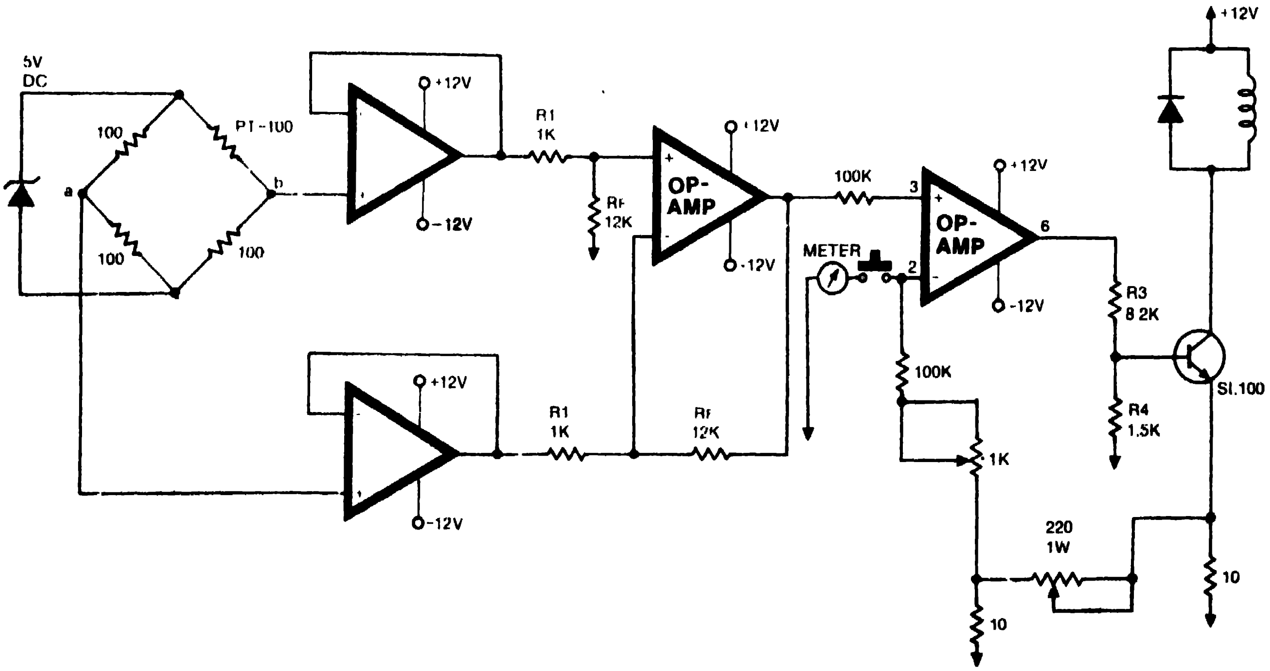


Fig. 3: Circuit diagram for temperature controller.

found out from the following equation:

$$V_{ab} = \frac{-\Delta R\, V_{de}}{(2R + \Delta R)}$$

After amplification through op-amp having RF as feedback element, output voltage can be arrived at by the following equation:

$$V_o = V_{ab} \times \frac{RF}{R1}$$

It can be seen from the above equations that output voltage is a function of ΔR, i.e. the variation in the transducer resistance.

In order to reduce error due to load connection, transducer is connected in three wire system. Since, length of incoming/outgoing leads of the transducer depends upon the location where temperature is required to be sensed, the resistance effect introduced due to these lengths is nullified in this way.

The amplified voltage is fed to comparator where set point and measured output is compared and the difference of the two signals is amplified and used to bias the transistor to operate the relay. Thus, the circuit for controller consists of only a preset, a comparator and a switching stage to convert electronic thermometer into thermostat.

A set point is selected by pressing pushbutton and adjusting 10-turn potentiometer with screwdriver till the desired value is indicated by the meter. This value is indicated at pin 2 of IC shown in circuit. If the measured voltage at pin 3 is greater than reference temperature set at pin 2, voltage at pin 6 is high. A current will flow through biasing resistor R3 which is sufficient to cause drop of about 1.5V across R4. This is more than enough to make transistor conduct.

A number of comparators are used for achieving two or three set points, and process control for two or three defined points of temperature can be easily achieved with this circuit.

Thermocouple can also be used in the present circuit with a little modification in the measurement circuit. The output from thermocouple is directly obtained depending upon cold and hot junction temperatures. Since temperature of cold junction depends upon ambient temperature, the thermocouple has to be cascaded with wheatstone bridge output for adjustment of ambient. If this set-up is to be used with either RTD or TC, two-way switch can be used to connect either sensing elements desired for any particular range of temperature.

Operational requirement

If the period of duty cycle of the relay happens to be too much, the relay is found to chatter. A 220-ohm potentiometer is provided in feedback circuit of the comparator. This should be adjusted to reduce or increase the gain in the feedback to avoid this defect. The operation, otherwise, is very simple.

Electronic circuit for temperature control is better suited where accurate control is required. Thermostats are used for rough control. Being electromechanical devices, they wear out and therefore repeatability is lost. Hence electronic control is good for accuracy, repeatability and better resolution. □

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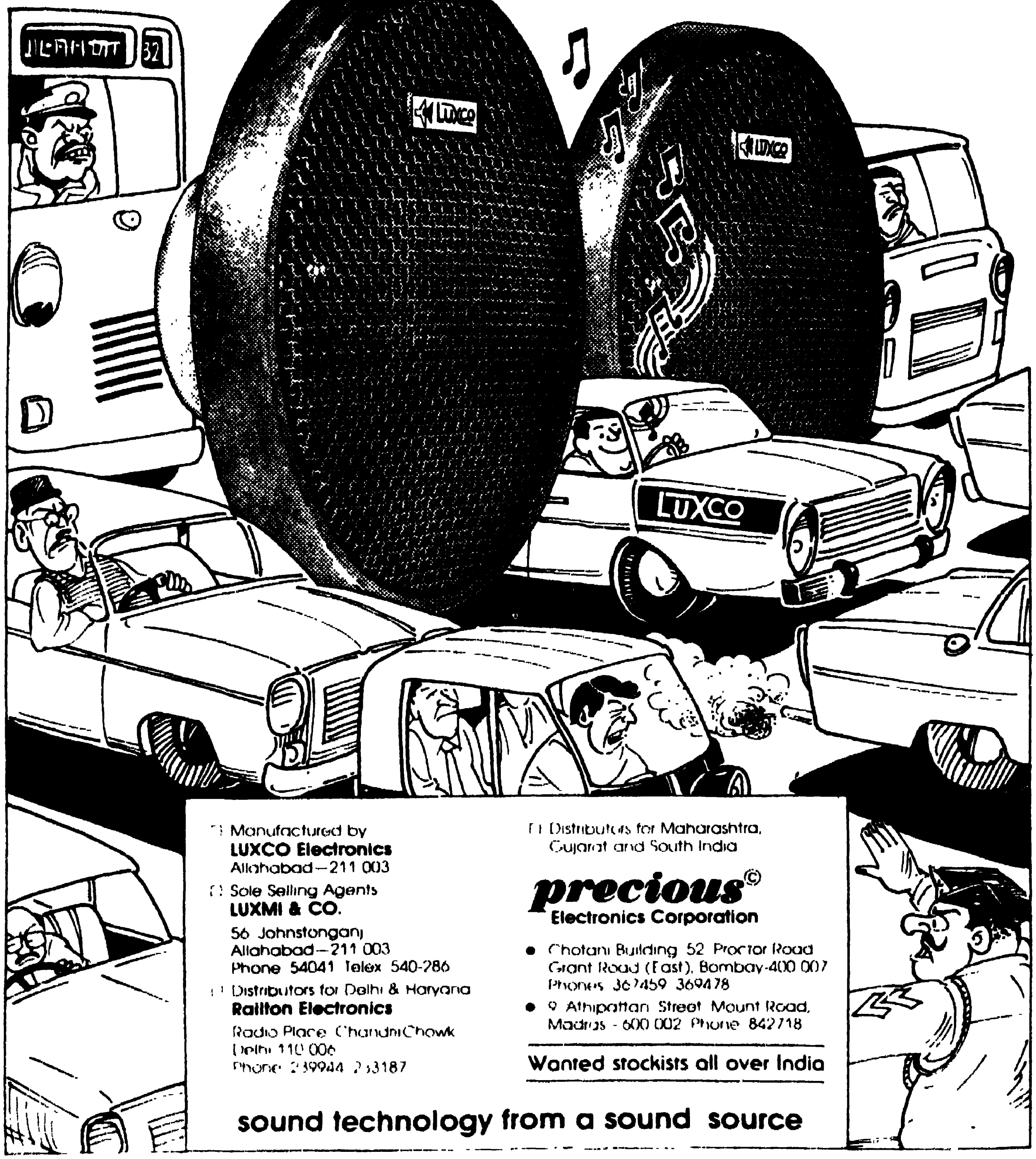

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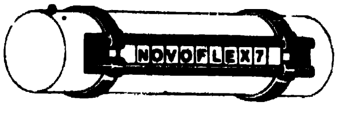
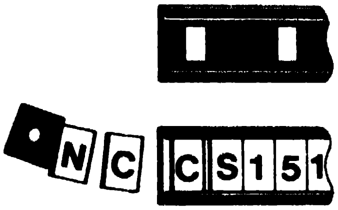
Product Profiles

LABELS AND CABLE MARKERS

Starlite has designed ready-to-assemble Labels and Cable Markers to be assembled at site without waiting for engraving They can be readily altered if necessary and are cheaper than other types of labels used with fixing screw or adhesive



RTA CABLE MARKERS



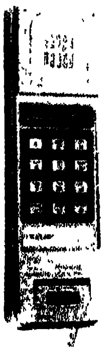
LABELS AND CABLE MARKERS

The ready-to-assemble labels are supplied in a handy kit form also, containing label holders, letter-figures, spacers and end stop for assembling 50 different labels They can be very conveniently used for marking on cables by fitting it with alpha strip of 4mm These RTA cable markers can be used either at the end of cables or at any intermittent position. Legends up to 14 digits can be assembled.

Contact: Starlite Enterprises, 124B Vivekananda Road, Calcutta 700006.

PUSHBUTTON TELEPHONE

Kayjay Pushbutton Telephone KJ 100 is an elegant handy telephone instrument with soft touch keyboard, 17-digit dialling facility, mute button for private conversation, on/off ringer switch and last number redial facility



PUSHBUTTON TELEPHONE

Single piece unit for table or wall hanging is also available.

Contact: Kayjay Engineers, 123 Mahatma Gandhi Road, Bombay 400023.

PCB REPAIR KIT

Eltecks Corporation offers PCB Repair Kit, making available all the materials required for the PCB repair, in one pack at economical prices

The kit consists of Eltecks air-drying conductive silver preparation No 1228, paste thinner 0070, special solder wire, soldering flux, brushes and other miscellaneous materials which are required These are packed in a decorative wooden box for the user's convenience

The kit is useful in all industries, irrespective of their nature where quick, convenient and reliable repairing/servicing is required for the electronic/electrical equipment.

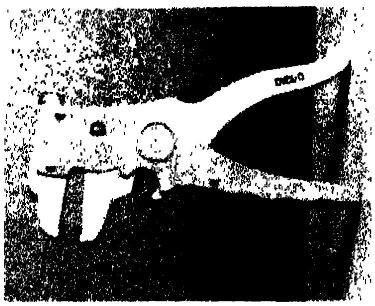
Contact: Eltecks Corporation, C-314 Industrial Estate, Peenya, Bangalore 560058.

SELF-ADJUSTING CUTTER-STRIPPER

Cycl-O has developed a new Self-adjusting Cutter-cum-Stripper for electrical cables up to 5mm in diameter

The stripper strips wires of up to 25 mm/2 54 cm in length. In one minute, the stripper gives minimum 100 strokes

Contact: Cycl-O Computers, 625 Panchratna, Opera House, Mama Parmanand Marg, Bombay 400004



SELF-ADJUSTING CUTTER-STRIPPER

DIP-SOLDERING SYSTEM

Control Signals has developed a versatile Dip Soldering System for mass soldering of PCB assemblies The system incorporates a solder bath with roboust and reliable sealed cartridge heaters and a precision temperature controller The equipment has its own unique dipping mechanism which takes care of different PCB sizes, weights and solder level in the bath

This Dip-Soldering System can be coupled to a foam-fluxer and preheater developed especially for this application The complete system (foam-fluxer, preheater, dip-soldering plant and cleaner) comes in various sizes and solder capacity

Unique heater design and heating schedule reduces dross formation to a minimum and maintains a uniform temperature distribution The dipping can be manual or automatic with precise timing and controlled motion

Contact Control Signals, C-62 Hari Nagar Ashram, Mathura Road, New Delhi-110014

DIP-SOLDERING SYSTEM

INK CARTRIDGES

The latest Ink Cartridges developed by Suvichem is suitable for Taylor's recorder model 90J.

Suvichem slow drying inks filled in these cartridges can be supplied with red, green, blue, black, violet, orange and yellow coloured inks. The cartridges are made from best quality high density polytheylene. Ink cartridges as per specifications can also be supplied.

Contact: Suvichem Inks, 1064 Shahabad, Bareilly 243003.

DIGITAL TEMPERATURE INDICATOR/CONTROLLER

Beacon Digital Temperature Indicator/Controller model IC-96 digitally indicates temperature in various ranges from -100°C to +500°C with 3-digit bold displays. It has a built-in comparator and relay that can be set to any desired temperature value on the scale.

The indicator/controller is housed in compact 96 mm × 96 mm panel mounting case of 150 mm depth The accuracy is ±1% for indication as well as control One changeover contact of the relay is available for outside

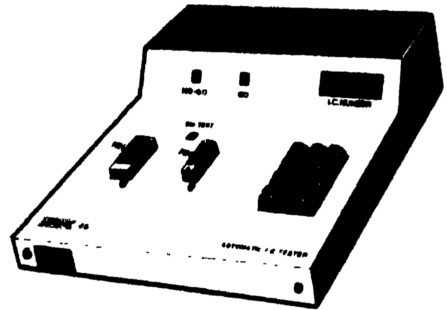
DIGITAL TEMPERATURE INDICATOR/CONTROLLER use. The contact capacity is 3A at 230V AC.

Green and red dual LED in the front dial indicates relay position. The instrument works on 230V AC mains ±10% variations.

Contact: Beacon Industrial Electronics Pvt Ltd, A-13 Shri Ram Industrial Estate, Katrak Road, Wadala, Bombay 400031.

AUTOMATIC DIGITAL IC TESTER

Agronic-46 is microprocessor based Automatic Digital IC Tester suitable for almost all CMOS and TTL ICs having maximum of 24 pins.


AUTOMATIC DIGITAL IC TESTER

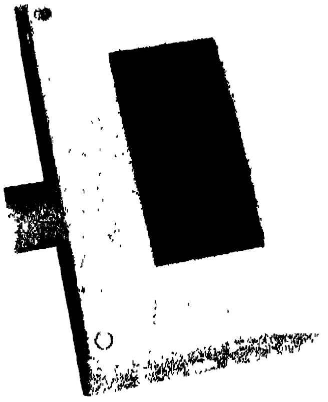
Agronic-46 has a simple keyboard for entering IC type numbers which are displayed on 5-digit bright LED display. The single touch of 'TEST' key enables functional testing of the IC The result of IC being functionally good or defective is indicated by 'GO' and 'NO-GO' LED indicators.

It incorporates built-in overload protection to prevent damage to IC tester and IC for defective or wrongly loaded IC It is internally programmed for testing of almost all CMOS and TTL ICs Agronic-46 speeds up IC testing with speed being determined by insertion or removal of IC in zero insertion force sockets.

Contact. Agronic Instruments Pvt Ltd, 201 Shivshakti Industrial Estate, Near Shreyas Cinema, L.B.S Marg, Ghatkopar (W), Bombay 400086

FLAME FAILURE DETECTOR

Otronic has developed Flame Failure Detector type FFD/L incorporating adjustable sensitivity and fixed sense-delay for monitoring flame presence in furnaces and boilers, reliably and automatically.


FLAME FAILURE DETECTOR

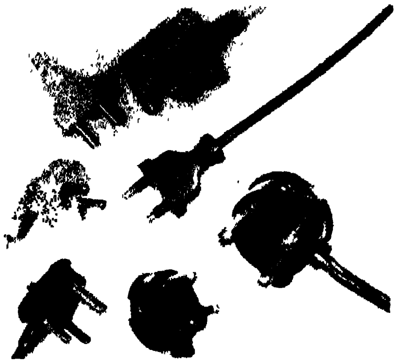
The presence of a flame energises the relay instantly and failure of the flame for a preset duration de-energises it. The delay ensures that a real failure has occured and not a flicker or momentary interruption. The sensitivity controls adapts the monitor to a weaker or stronger flame as the case may be.

Type FFD/L is suitable for luminous yellow flames such as in oil or coal fired furnaces and boilers and uses photoelectric scanner. The whole unit is environment-proof with built in surge protector and housed in cast aluminium.

Contact: Otronic, P.O. Box No. 2118, Lawyers Chamber-Ground Floor, 18 Picket Cross Road, Bombay 400002.

MOULDED MAINS AND EXTENSION CORDS

Harry Electronics manufactures a vast range of moulded Mains and Extension Cords including 2-pin 5A plug in different shapes, 3-pin 5A plug in two shapes and 3-pin 15A plugs; and also 30A moulded cord All the moulded cords are suitable for 250V AC.


MOULDED MAINS AND EXTENSION CORDS

The plugs are moulded with 2 and 3-core wires with the required lengths of cable. The extension cord is manufactured in the same shape as that of the mains cord to suit identical current ratings. The brass parts are used as per ISI specification The PVC used is of high dielectric insulation.

Contact: Harry Electronics, 227 Unique Industrial Estate, Off Veer Savarkar Marg, Prabhadevi, Bombay 400025.

PCB CLEANING MACHINE

Handles, Switzerland offers its HR-327 model of PCB Cleaning Machine which is a continuous cleaning station with combined condensate flushing and underside rotating brush device, with distillation unit.

The continuous distillation of the solvent maintains constant quality of the cleaning procedure. Any possible trace of water in the solvent is removed continuously by means of a molecular filter integrated in the distillation circuit.

The completely enclosed station and the arrangement of the cooling coils ensure an extremely low loss of solvent. The cleaning trough has an acrylic hood to allow supervising of the cleaning procedure. PCBs which may not be cleaned at all, are automatically led onto a second transport level by a programme controlled switch. The cooling and heating cycles, coupled through a heat pump, are self regulating. It works off 220V/380V, 50 Hz.

PCB CLEANING MACHINE

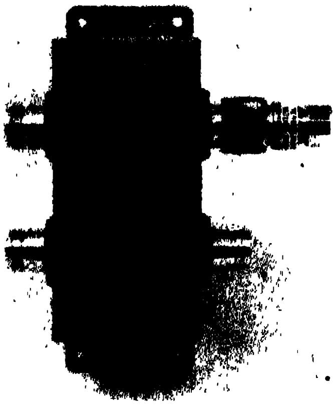
Contact: Arem Electro-Technics India Pvt Ltd, 125 Vayupuri, Secunderabad 500594.

HF COUPLER

Bird's Model 4266 is a high power bi-directional HF Coupler with a continuous rating of 1500 watts CW in the primary line.

It has an nominal coupling flatness of ± ¼ dB over the frequency range of ± 1/10 dB, providing a signal sample of forward and/or reflected power decoupled by 30 dB from the mainline.

Owing to Model 4266's total symmetry in design, input and output can be reversed. Forward and reflected signal samples are available from the secondary line simultaneously. Besides, the coupler's directivity is guaranteed even at 20 dB. It has a low insertion loss of 1/10 dB and a VSWR of 1.05. It measures power frequency, VSWR and attenuation.


HF COUPLER

Contact: Inde Associates, 202 Vikram Tower, Rajendra Place, New Delhi 110008.

ANTI FRICTION PADS

StopSlip Antifriction Pads from Spirig, Switzerland are made of durable, flexible plastic material with extremely high coefficient of friction against other dry materials.

ANTIFRICTION PADS

Placed above the table, they form an excellent working environment where small components can be easily handled as they do not slide or roll away when some pressure or force is applied to them.

StopSlip pads are mechanically strong and can withstand rough handling, yet protecting delicate surfaces from scratching.

Contact: Jainsons Engineering and Electronics Corporation, 175 Samuel Street, Post Box No. 5245, Bombay 400009

SWITCHABLE DIP ATTENUATOR

VRN International offers new series 7010 Switchable DIP Attenuator that solves the problem of reducing the energy in a signal without introducing distortion.

The 7010 is a balanced T-type attenuator, available in 50, 75 and 600-ohm impedance values. This component is an 8-pole device with a standard 16-pin DIP configuration, available in standard attenuation increments of 0.1 dB to 1.5 dB.

SWITCHABLE DIP ATTENUATOR

A precision laser trimmed thick film resistor network mated to a high quality gold contact switch system, the 7010 is available unsealed, or can be provided with a peelable, plastic adhesive which is easily removable after aqueous wash.

Contact: Al-Tronics International, 243 Dr Cawasji Hormusji Street, 3rd Floor, Bombay 400002.

COMPREHENSIVE INTERFACE SYSTEM

The Comprehensive Interface System (Cif) from U-Microcomputers Ltd is a modular interfacing system which provides 8- or 16-channel, 12-bit A/D input, 4-channel 12-bit D/A output, digital lines for input or output and timers.

It is available for the Apple II and compatibles, IBM PC and compatibles and for U-Micro's own 32-bit micro the U-MAN series 1000. In each case, the system consists of a digital card taking up a single slot in the host computer and an external case which houses the other units. This case also contains a power supply and easy-to-use connectors along the front. By removing the A/D and D/A functions from inside, the electrically noisy environment of the computer itself true 12-bit resolution is achievable

The functions are easily programmed for particular applications from most languages and operating systems. However, for the Apple II, a general-purpose suite of acquisition and processing software called ACQ-SOFT is available. This package allows data to be collected, displayed in graphical form, scaled, saved to disc or printer and includes statistical manipulations.

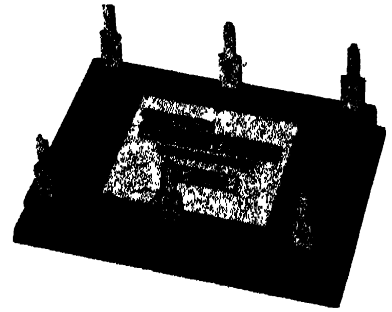
COMPREHENSIVE INTERFACE SYSTEM

Contact: U-Microcomputers Ltd, Winstanley Industrial Estate, Long Lane, Warrington, Cheshire WA2 8PR, England

POWER MODULES

Gentron offers low cost L-series line of Power Modules The L series offers a cost effective approach over discretes, and can include SCR, diode, bipolar, darlington, or MOSFET circuits

The L-series is the first SCR bridge having terminals suitable for printed circuit board use The cost and problems of assembling, isolating and heatsinking discrete components are eliminated. The L-series features excellent thermal efficiency because of an exposed ceramic base plate and the patented Powertherm process which results in reduced heatsink requirements and more reliable operation.



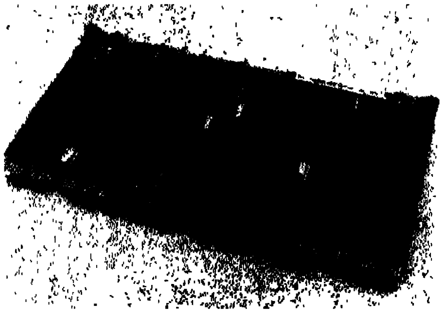
POWER MODULES

A variety of single phase, three phase and doubler circuits are available, as are also ½ H and full H configurations. The SCR modules are supplied in ratings of 13 to 42.5 amps and up to 280V AC.

Contact: Gentron Corporation, 6667 North Sidney Place, Milwaukee, WI. 53209, USA.

SMD DISC CONTROLLERS

Two enhanced SMD Disc Controllers for PDP-11 Unibus and VAX systems, with data transfer rates up to 1.8 Mbytes per second have been introduced by MDB Systems Inc



SMD DISC CONTROLLERS

Designated the MDB-DK11-RM and MDB-DK11-RP, the hex size controllers will operate disc drives with an SMD interface that can operate at the standard data rate of 1.2 Mbytes per second, as well as the 1.8 Mbyte When used with Control Data 9762 or 9766 drives, the disc controller will generate packs that are media compatible to DEC RM02/RM05 systems.

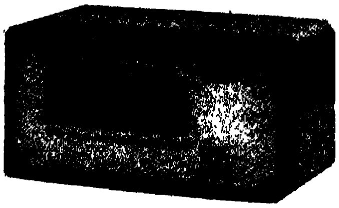
The MDB-DK11-RM provides RM80, RM02, or RM05 emulation modes, and the MDB-DK11-RP provides RP06 emulation, making them transparent to most DEC operating systems software. Either controller can support four physical drives A key feature of the controllers' capabilities is the method used for drive address mapping Other significant features of the controllers are on-board hardware ECC correction, firmware format, and firmware boot.

Contact: MBD Systems Inc, 1995 N. Batavia Street, Box 5508, Orange, California 92267, USA

DIGITAL INDICATORS

The MTL 633 and 634 from Measurement Technology Ltd are two new intrinsically safe Digital Indicators for displaying process variables. Loop powered, they drop less than 1V, and can be connected into any IS 4-20mA loop without further certification

Both models have 3½-digit liquid crystal displays, and feature built-in reference signals for immediate on-site loop calibration without separate test equipment. Suitable for installation directly in the field, the units meet IP65 environmental conditions and may be mounted on a pipe/post, surface or panel.



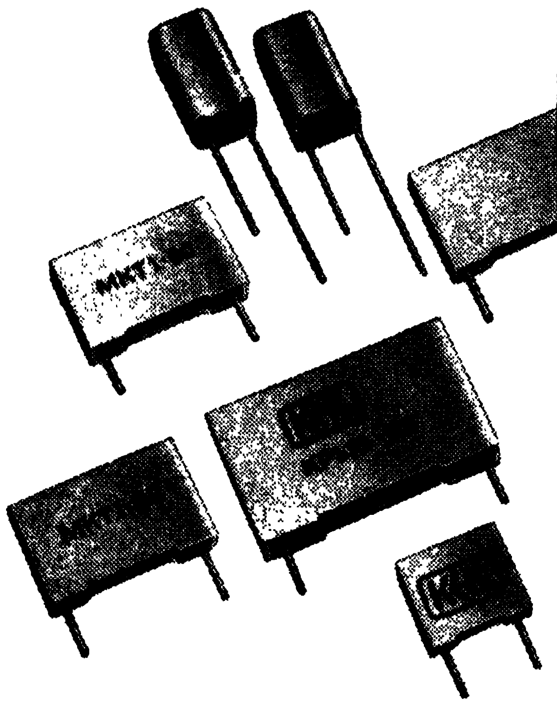
DIGITAL INDICATORS

The MTL 633 is user-selectable for root extracting or linear applications, while the MTL 634 is linear only. Flow or linearly-derived signals can therefore be displayed.

Contact: Measurement Technology Ltd, Power Court, Luton, Beds. LU13JJ, England.

KEIL Plastic Film Capacitors in Box configuration.

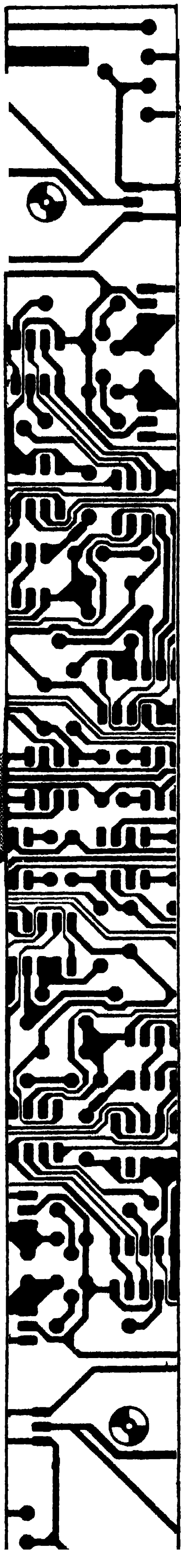
A complete package for entertainment and professional electronics.

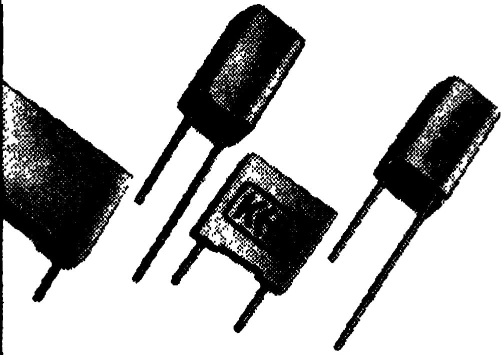


Kothari Electronics & Industries Ltd.
"Kothari Buildings"
114, Nungambakkam High Road
Madras 600 034, INDIA

KEIL Capacitors—a generation ahead of others in technology.

KEIL 4020





For your unique circuit needs KEIL has the answers.

In collaboration with world renowned Plessey Italia (now ARCOTRONICS ITALIA S.p A) KEIL produces a complete range of plastic film capacitors to satisfy the specific needs of Black & White—Colour TVs, telecommunication equipment, Power Electronics, analog/Digital systems etc.

Metallised Polyester/ Polypropylene Capacitors

Produced to IEC standards using latest state-of-the-art automated machines, Miniature, radial lead Metallised Polyester/Polypropylene capacitors, in wide varieties, offer excellent choice to designers for selection of the right capacitors for specific functions. Ultra modern spraying and welding facility together with box encapsulation ensure excellent electrical, mechanical and environmental characteristics for reliable long term performance.

Metallised Polyester Capacitors

MKT 1 56	0 010 uF — 1 uF	250V—400V
MKT 1 60	1000 pF — 6 8 uF	100V—1000V
MKT 1 58X	0 01 uF — 0 47 uF	250VAC
MKT 1.67	1000 pF — 0 33 uF	100V—630V

Polypropylene capacitors

MKP 1.71	1000 pF — 3 3 uF	160V—630V
KP 1.73	1000 pF — 0 22 uF	630V—2000V
MKP 1.76	0 01 uF — 1 uF	250V—400V

Precision Grade Polystyrene Capacitors

Made to E 192 series as per IEC specification upto a close tolerance of ±0.5%, with very high reliability and stability factor. Made specially for telecommunications and other precision circuit requirements.

KS 1 16	47 pF — 603000 pF	63V—1000V
KS 1 30	47 pF — 34000 pF	63V
KS 1.39	47 pF — 603000 pF	63V—1000V
KS 2.34	47 pF — 220000 pF	100V—500V
KS 2.31	10 pF — 100 pF	160V

We have a full-fledged application support group, which will help you to select the ideal capacitor Please write to us.

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A Feather in our Cap!

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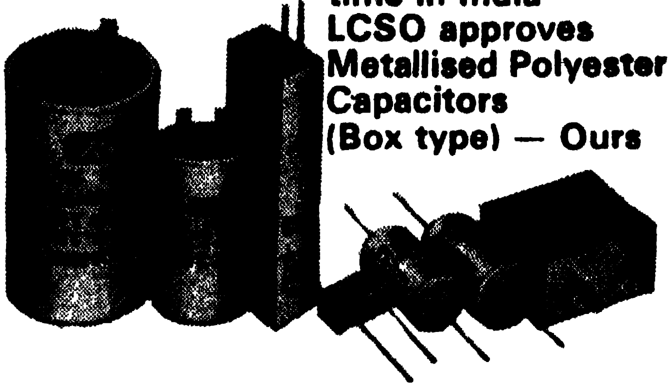

Our Polystyrene Capacitors too get the nod from LCSO

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FACTORY. 45, METAGALLI, K.R S ROAD, MYSORE-570016
PHONE. 25766

ADWIT/OCEL/736-83

POWER LINE PROBLEMS?

What do you have in common with the following:
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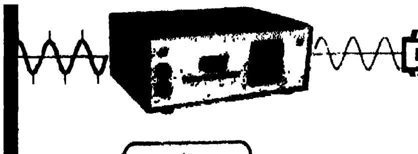
Hindustan Aeronautics Limited, Lucknow
Indian Oil Corporation Ltd (R & D), Faridabad
R.D.S.O. (Ministry of Railways), Lucknow
Indian Institute of Sciences, Bangalore
Jawaharlal Nehru University, New Delhi
Electronics & Radar Development Estt, Bangalore
Gujrat Communication & Electronics Ltd, Baroda
International Airport Authority of India, Delhi
Bhabha Atomic Research Centre Bombay

all of them use sophisticated Electronic equipment or Computer, which is susceptible to power line problems of voltage spike/surge, RF noise due to ESD, EMP, EMI etc.

Like them, you too can improve the performance of your equipment by feeding it CLEAN POWER through 'HILL' Power Line Isolator.



Tested by E.R.T.L. (N) Dept. of Electronics Govt. of India

Contact: Dawn Digital
Post Box 6020, New Delhi-110 008
Ph: 571 7943 Telegram: BITBYTE

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FOR REPAIR & SERVICING OF THE FOLLOWING COMPUTERS AND PERIPHERALS
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APPLE IIe, II PLUS, IIc
SINCLAIR ZX SPECTRUM,
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CONTACT:

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B-7/101/1, SAFDARJUNG ENCLAVE
NEW DELHI 110029
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- Input/driver Transformer
- Custom Built Transformer

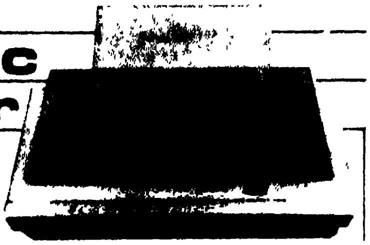
For further information kindly contact:

J.J. ELECTRONICS
A-23, Mayapuri Industrial Area, Phase II,
New Delhi 110064 Phone: Fac 591839, Res 621258, 619526

SEIKOSHA

GP-250X

Programmable Graphic Printer



The Most Intelligent and Elegant Printer– If you want a printer that not only does what it is told, but REMEMBERS, What it was told, then the GP-250 X Graphic Printer is for you. BOTH serial (RS-232C) and parallel (Centronics compatible) interfaces are standard.

A Small Quantity available Ex stock HURRY UP

- SEIKOSHA-GP-700A-Graphic Colour Printer
- Floppy drive for Apple II'
- Mono-chrome Monitors-12" Green Phosphor
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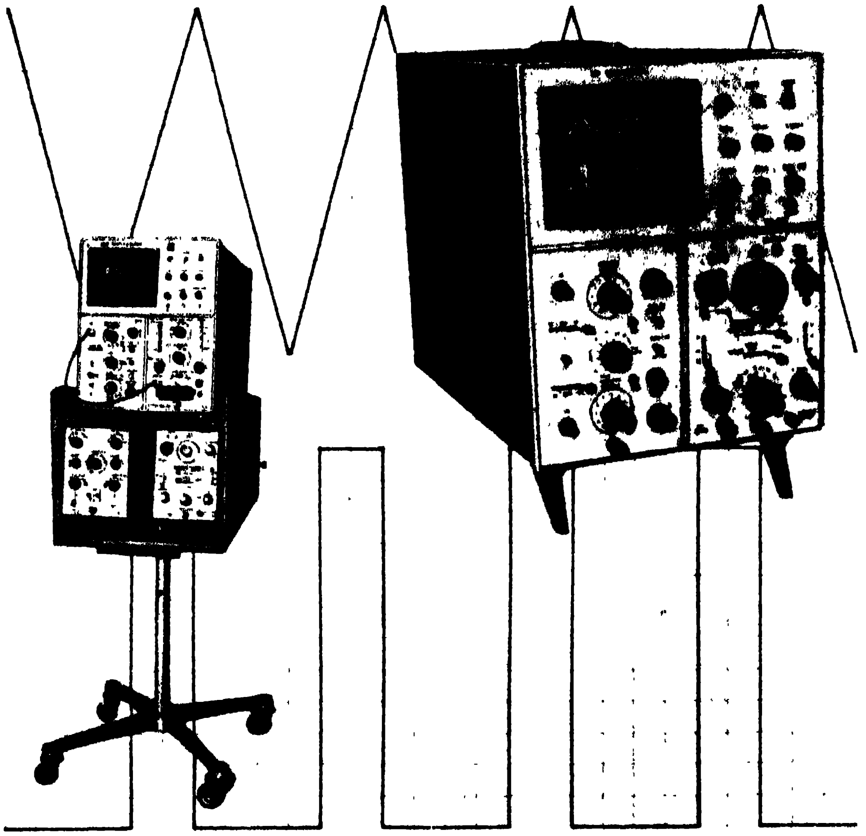

MODEL 550

- ★ Fully Solid State Using ICs
- ★ Ruggedised, Defence Approved
- ★ Plug Ins For Versatility
- ★ Wide Band Width, DC–50 MHz
- ★ High Sensitivity 20 μV/DIV
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- ★ Dual Trace
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PLUG INS

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Choose other Models from the widest range in the country Portable (505/DM, 550/DP) or Laboratory, Plug Ins (520 – Low Cost DC–20 MHz, 535 DC - 35 MHz) or Stand Alone (505/S, 505/D, 510/D, 515/D, 515/S, 525/D) Band width 5 MHz to 50 MHz Single, Dual or Four Traces TV Line, Frame or Mains Trigger, Frequency Counter, Digital Multimeter, Power Supply or Curve Tracer Option.

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Ahmedabad 382 330

GP to make hard ferrites

GP Electronics Ltd, a new company, is to set up a unit for the manufacture of hard ferrites in technical collaboration with Tokyo Kikai Sangyo Company, Japan.

The plant, located at Ambad in Nasik district of Maharashtra, will have an installed capacity of 660 metric tonnes per annum in the first phase which is proposed to be raised to 1200 metric tonnes in the second phase. The raw materials required for the production of hard ferrites are readily available in the country. The main machinery and equipment incorporating the latest technology have been imported from Japan and West Germany The company expects to start commercial production by September this year.

To raise part of the capital, the company had offered equity shares to the public. The company is confident of a good market in the country since hard ferrites are essential electronic components for a number of consumer as well as industrial products

Blue Star signs agreement

Blue Star Limited has signed an agreement with the French company Jeumont Schneider for the manufacture of electronic PABX systems.

The production at Blue Star's second factory at Gandhinagar is expected to commence in early 1986 with an investment of Rs 350 million. The company will manufacture models Jistel 40, 50, 95 and Jistel 200 which have modems for electric interface, and Jistel 500 and TLC 10 which are digital systems.

As much as 50,000 lines are expected to be manufactured over five years with an expected turnover of Rs 500 million.

Tandon to set up new plant

Tandon Magnetics, leading manufacturers of 13.33cm floppy disc drives, propose to set up a new plant at Nasik, Maharashtra. The initial capacity of plant will be about 5000 drives, and the production will be expanded to 20,000 drives per annum in the second phase.

At present Tandon manufactures 13.33cm half height floppy disc drives at its SEEPZ plant in Bombay which are exported the world over and used by leading computer manufacturers in America and Europe. Its patented read/write head, the heart of a floppy drive, is used by all disc drive manufacturers.

Since these drives are only half the height of an ordinary drive, computer manufacturers can install two Tandon drives in the place of one full height drive. This means that the computer user gets just over two megabytes of storage on his machine, enough to store all the text in a four-volume encyclopaedia.

To keep these drives operational, Tandon is setting up initially a full fledged service centre outside SEEPZ Service centres will be set up in other cities as and when the need arises

C.H. Krishnan offers DESC certified ICs

Analog Devices Inc., a leading manufacturer of hybrid linear integrated circuits and represented in India by C H Krishnan & Associates, has achieved certification from the Defence Electronics Supply Center (DESC) of the company's compliance with MIL-STD-1772.

The military standard, which specifies certification requirements for hybrid manufacturing facilities, was introduced by DESC in an effort to standardise military processing and enhance the quality of military hybrids

The MIL-STD-1772 certification was sought in order to fulfil a future requirement for producing MIL-STD-883B, Rev C. hybrid parts Certification to MIL-STD-1772 is evidence of Analog Devices' commitment to providing high-quality, high-reliability parts

BEL to make glass tubes

Bharat Electronics Limited (BEL) is constructing a plant for in-depth production of one million glass tubes for TV picture tubes at Taloja near Bombay. This plant is being set up in collaboration with Corning of USA and France. The plant is expected to go into production during 1986.

BEL has also taken steps to expand the plant so that it can produce up to three million glass bulbs in sizes of 51 cm and 35.5 cm. BEL will make use of indigenously available raw materials for production. ONGC plant at Uran processing crude oil from Bombay High offshore installations will supply natural gas to energise the BEL glass bulb plant at Taloja.

The BEL plant at Taloja is a continuous process plant, which will work round the clock in three shifts, employing 50 executives and 500 workers

ECIL to make mainframe computers

The Electronics Corporation of India Limited (ECIL) has been designated to initiate the manufacturing activity for mainframe computers with foreign technology However, the investment decisions on this are yet to be taken.

The selection of the collaborator has not yet been finalised. The offers from two companies, namely, Control Data Corporation, USA and Bull, France have been shortlisted against a global tender floated by the Department of Electronics

On the television front, ECIL plans to produce over 100,000 TV sets in 1985-86 as against 57,000 in 1984-85. Of these 50,000 will be colour TV sets including remote control CTV sets which were recently launched

HTL tie-up with French firm

The Hindustan Teleprinters Limited (HTL) is to set up a factory at Hosur in district Dharmapuri, Tamil Nadu for the manufacture of electronic teleprinters in collaboration with Sagem of France.

The project is expected to commence production during the current financial year in which 3500 electronic teleprinters will be produced. By 1988-89, when the fourth and last phase is expected to be completed, the production capacity will be 8000 units per year.

HTL has also signed an agreement with its original collaborators—Olivetti of Italy—for producing electric typewriters. The company also proposes to develop Hindi and Tamil electric typewriters using knowhow from Olivetti. The prototypes for Devnagari and Tamil electric typewriters are undergoing trials at the company's research and development laboratory.

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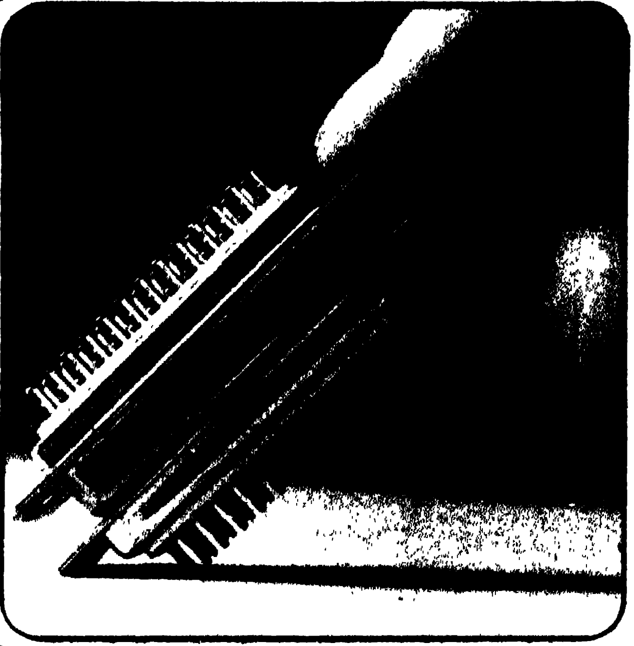

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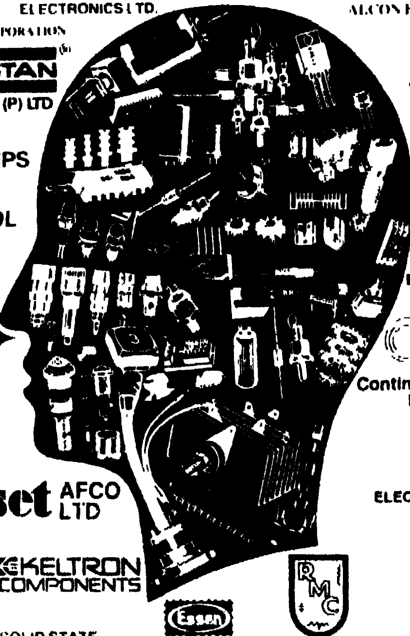

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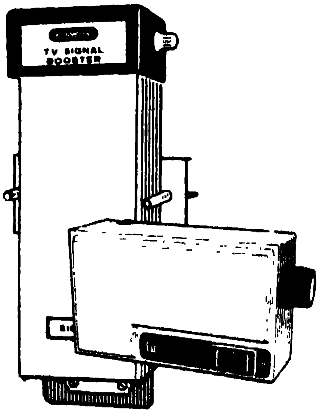

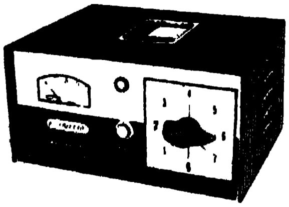

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Book Reviews

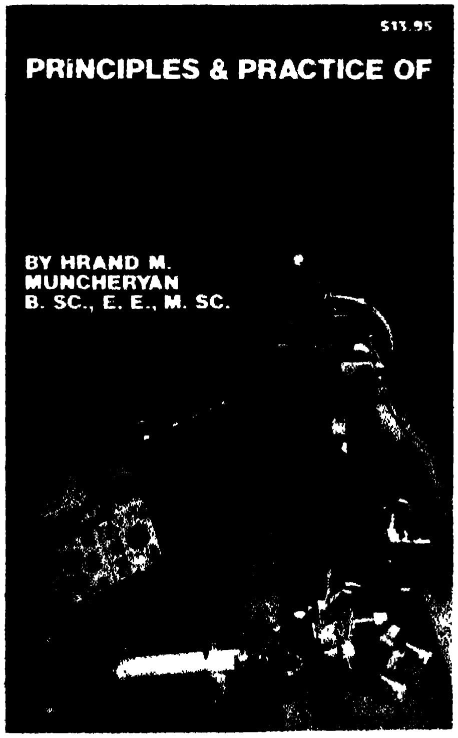
Principles & Practice of Laser Technology

By Hrand M. Muncheryan, published by Tab Books Inc., USA; pages 298 (13 cm × 21 cm); soft cover; price: US $ 13.95.

Laser technology, like other scientific fields, has advanced to a stage where mere empirical methods of learning have become inadequate, putting stress on the fundamentals of the physical phenomena that pertain to geometrical optics, radiation and interferometry.

This book is a highly informative handbook giving both the theoretical and practical aspects of modern laser technology like laser generation, systems development, operation and applications in the varied branches of industry, military and biomedical profession.

The book is divided into seventeen chapters which cover almost the entire gamut of laser technology. The introduction to lasers in chapter one is followed by laser radiation principles in chapter two. Chapters two to five discuss laser systems such as ionic, modular, solidstate and diode. Liquid dye lasers are explained in chapter six while the industrial applications of lasers are described in the next chapter.



Metrological measurement systems are described in chapter eight while chapters nine and ten discuss aerial laser-beam and fibreoptic communications. Principles of holography are explained in chapter eleven. The next three chapters examine the applications of lasers in fields of military, medicine and dentistry.

Chapter fifteen describes atomic transmutation with lasers and laser systems and characteristics are discussed in the next chapter. The last chapter of the book gives a selected collection of laser-aided developments in various fields.

The five appendices at the end of the book provide additional information and data on important aspects of laser technology. In all, the book professes to teach the principles and practices of laser technology and in this sense it will prove useful for both the hobbyist and the professional. —R.B.

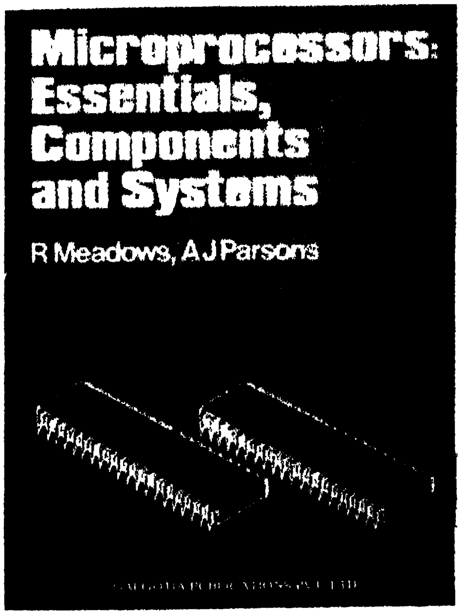
Microprocessors: Essentials, Components and Systems

By R. Meadows & A.J. Parsons, published by Galgotia Publications Pvt Ltd, New Delhi; pages 250 (18.5 cm × 24 cm); hard cover; price: Rs 150.

Since the advent of computers or microprocessor-based systems, there has been an innundation of books on microprocessors which are either too theoretical or too technical for the ordinary user. This book on microprocessors tries to combine the theory and concepts required by the beginner with the practical and specialised applications of microprocessor for the higher level of users.

The book, divided into eight chapters, begins with an introduction of the basic hardware units making up a typical digital computer system and some important terms associated with computing systems. Chapter two describes the basic concepts concerning binary numbers and computer arithmetic.

Logic devices, circuits and operations, the general hardware fundamentals are discussed in chapter three. The basic building blocks and concepts associated with digital logic circuits and systems are also considered here. Chapter four describes the basic architecture and the principles of operation of a microprocessor system. This chapter provides a link between the general concepts contained in the first three chapters and the more detailed software and hardware subjects in the following chapters. The internal architecture of two widely used microprocessors—the Rockwell 6502 and Zilog Z80–is described in detail here.



Chapter five explains the methods used to program the microprocessor to perform its tasks: types of instruction, addressing modes, machine and assembly code programming. Computer storage devices—magnetic, disc, tape and semiconductor memories—all the devices commonly used to store programs, data and results are examined comprehensively in chapter six.

Chapter seven discusses the construction and operation of peripheral equipment to and from the computer like input keyboard devices, printers, LEDs, LCDs, VDUs, graph plotters etc as well as interfacing techniques and A/D, D/A conversions.

The final chapter gives some practical examples of the use of microprocessors: in weighing, waveform synthesis and central heating control to show the versatility and advantages of microprocessor-based computer-controlled systems.

The two appendices give the instruction sets of 6502 and Z80 microprocessors. Each chapter includes a set of problems and answers to reinforce the subject discussed. —R.B.

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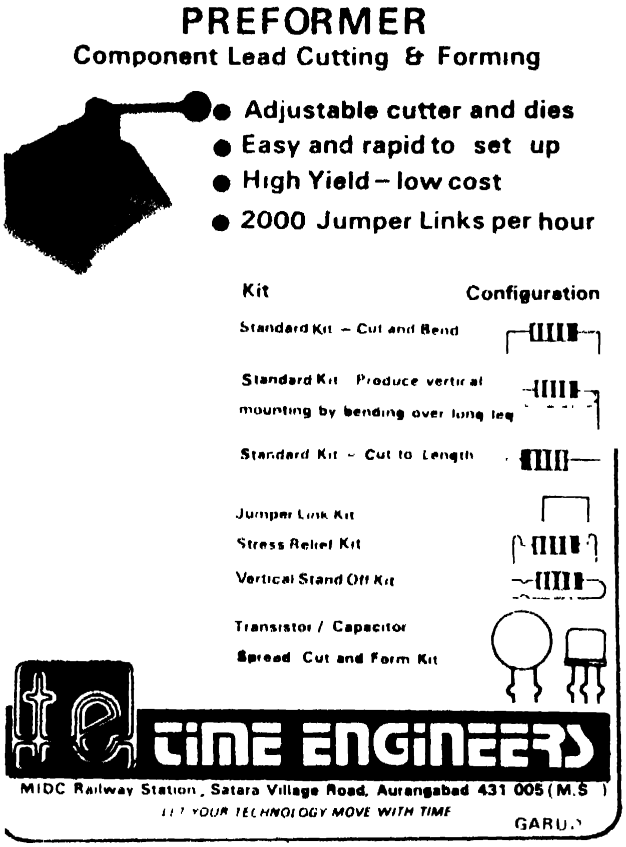

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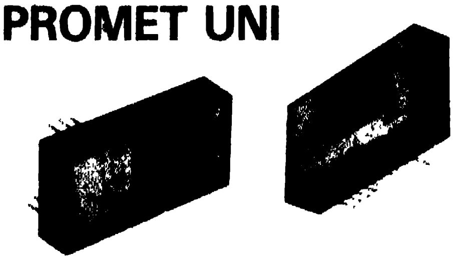

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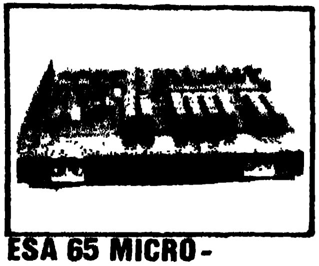
NEW MICROPROCESSOR PRODUCTS FROM ESA

ESA 65 is a low cost microcomputer built around Rockwell's 6502 CPU and its peripheral devices which are now being manufactured in India. ESA 65 is a complete single board microcomputer with very powerful system software, bridging the gap between the microprocessor trainers and microcomputers.

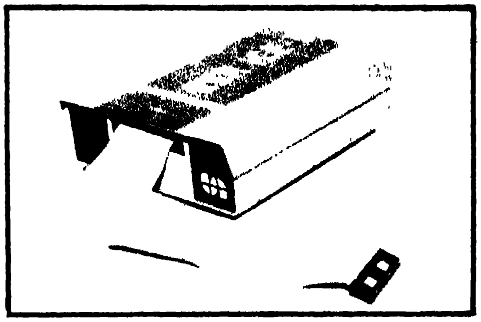


ESA 65 MICRO-COMPUTER/TRAINER

- Powerful System Software: EPROM resident PASCAL Compiler (optional) BASIC Interpretter (optional) Text Editor Assembler (optional), Disassembler, Keyboard and Serial Debug Monitor Programs.
- Two RS 232 C ports through two on board D-type connectors for terminal and printer, dual Audio Cassette Interface with remote controls for a complete microcomputer organisation.
- In both the modes of use, Keyboard and Serial, user can enter and debug programs through its powerful command set including Instruction Trace and Breakpoint facilities.

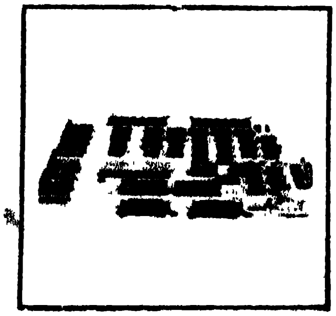
Microprocessor based products are more flexible and cost effective. But it is difficult to build and test them. Complex bus structures and timing relationships have practically obsoleted the line/voltmeter signal tracing techniques **ECA ICE-1 IS THE SOLUTION.** The ESA ICE-1 is used via an RS 232 C compatible interface. All firmware is within the module. This module has two PCBs; one controller card and the other a personality card for the microprocessor to be emulated. The ESA ICE-1 can be used on any display terminal like CRT terminal or with a computer system.

- Operation upto the full speed of the specified processor
- Target processor retains its entire memory and I/O space
- Emulation memory which can be mapped into any 8K block of target processor memory.
- Single address breakpoint with loop count.
- Forward and Backward Trace.
- Direct Input/Output commands
- Resident assembler and two-pass disassembler which assigns labels to subroutine and branch addresses.
- Built-in memory diagnostics and block memory transfer for the target processor's memory.
- Downloading and Uploading of target program between ICE and host computer system.



**ESA ICE-1
IN CIRCUIT EMULATOR**

ESA 68K Microcomputer Design Kit is a complete and powerful single board microcomputer based on Motorola 68000 CPU with support from the popular Intel peripheral chips.



ESA 68K MICRO-COMPUTER/TRAINER

Software: Debug Monitor, Line assembler, Tiny BASIC etc.
Hardware: Upto 128k bytes of EPROM and 32K bytes of RAM.
48 lines of parallel I/O (8255 × 2), RS 232 C Serial Communication (8251A).
Programmable Interval Timers (8253-5) Interrupt Priority Encoder etc.

OTHER PRODUCTS

8 bit Systems: Microprocessor Trainers ESA 85, MPS 85, SBC 85 based on 8085 and ESA 80 based on Z-80.
16 bit Systems: Microprocessor Trainers ESA 86, ESA 86/87 based on 8086 and its co-processors, Single Board microcomputer ESA 186 based on 80186.
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LICENCES AND LETTERS OF INTENT

The following licences and letters of intent were issued to electronics firms under the Industries (Development & Regulation) Act, 1951 during the month of March 1985

Name & Address of the Applicant and location of the undertaking	*Date & type of licence*	*Article*	*Quantity per annum*
(1)	*(2)*	*(3)*	*(4)*
LICENCES			
Elconment Ltd 289 Sahid Nagar, Bhubaneshwar (Distt Puri-Orissa)	6 3 85 (NU)	Metallisation on 1. Polyester film 2 Polypropylene film 3 Polycarbonate film	150 tonnes
A.B Controls Ltd 46-A Rafi Ahmed Kidwai Road Calcutta (Distt Nainital-UP)	11 3 85 (NU)	Integrated control automation monitoring systems, accessories, parts and allied products	250 systems
Murugappa Electronics Limited TIAM House, 28 Rajaji Road Madras (Distt Mysore-Karnataka)	12 3 85 (NU)	Audio magnetic tapes	2400 tonnes
G P Electronics Ltd Administrative Building Moranjee Mills Dr Ambedkar Road, Parel Bombay (Distt Nasik-Maharashtra)	15 3 85 (NU)	Hard ferrites	1500 tonnes
Punsumi India Ltd D-16 Meera Marg, Bani Park Jaipur (Distt Alwar-Rajasthan)	16 3 85 (NU)	Aluminium electrolytic capacitors	50 million nos
Debikay Systems Ltd S-323-A Panchsheel Park New Delhi (Distt Old Bulandshahr-UP)	19 3 85 (NU)	Colour TV receiver sets	50,000 nos
Bharat Electronics Ltd 'Trade Centre' 29/4 Race Course Road, Bangalore. (Distt Bangalore-Karnataka)	19 3 85 (NU)	Electron guns for black-and-white picture tubes	800,000 nos
Vijay Electronics Pvt Ltd Plot No. 28, Industrial Development Area, Balanagar, Hyderabad (Distt Medak-AP)	29 3 85 (NU)	Colour TV receiver sets	45,000 nos
Gujarat Transreceivers Ltd 4th Floor, Nataraj Chambers Ashram Road, Ahmedabad (Baroda-Gujarat)	29 3 85 (NU)	Two-way radio communication and allied equipment	Ex-factory turnover of Rs 30 million (to be reviewed after 5 years or earlier if the turnover limit has been reached)
Elico Sonics Ltd 6-3-1100/5 Rajbhavan Road, Somajiguda, Hyderabad (Distt Medak-AP)	30.3.85 (NU)	1 Loudspeaker cones, spider and dust cap 2 Kits consisting of coil centering ring, tag board, top plate, bottom plate, loudspeaker frame	8 million nos 6 million nos
LETTERS OF INTENT			
Crompton Greaves Ltd 1 Dr V.B Gandhi Marg, Bombay. (Distt Dhar-MP)	1.3.85 (NU)	Dedicated solidstate protection systems	Rs 20 million in terms of value
Ambalal Sarabhai Enterprises Ltd (ORG Systems Division) Wadi-Wadi, Baroda. (Distt Baroda-Gujarat)	1.3.85 (SE)	A.Minicomputer/microprocessor based systems. (The company is allowed to manufacture only five systems costing less than Rs 300,000	Rs 60 million
		B. Computer peripherals	Post expn Annual cap
		1. Line printers	900 nos.
		2. Magnetic tape drives	500 nos
		3. Magnetic hard disc drives	500 nos.
		4. Floppy disc drives	3000 nos
		C Other items	Post expn Annual cap
		1 CRT terminals	000 nos
		2 Graphic terminals	500 nos.
		3 Data entry terminals	1500 nos
		4 Phototype setting terminals	200 nos.
		5 Printing terminals (Dot matrix type)	1000 nos
		6 MICR equipments	1000 nos.
Electronics Corpn of India Ltd Industrial Development Area Cherlapalli Hyderabad. (Distt Ranga Reddy-AP)	5 3 85 (NA)	Computer based electrical load despatch systems	Rs 100 million in terms of value
Aptek Computers Pvt Ltd 113 Jolly Maker Chambers No 2 Nariman Point Bombay (Distt Baroda-Gujarat)	12 3 85 (NU)	1 Personal computers 2 Data acquisition systems	5000 nos 500 nos
Prof K N Sareen House No 1012, Sector 11-C Chandigarh (Distt Gurgaon Haryana)	12 3 85 (NU)	Electronic assemblies	Rs 3 million
Man Mohan Singh D-1-215 Lajpat Nagar, New Delhi (Any permissible area in the state of Delhi)	12 3 85 (NU)	Colour TV receivers	50,000 nos
Sanjeev Goyal 13 Ahmedabad Palace Karballa Road, Bhopal (Teh, & Distt Raisen-MP)	12 3 85 (NU)	1 Colour TV receivers 2 Black-and white TV receivers	50,000 nos 50,000 nos
Kinetic Engineering Ltd D-1 Block, Plot No 18/2 Chinchwad, Pune (Distt Dhar-MP)	12 3 85 (NU)	Colour TV receivers	50,000 nos
Linytron Electronics Pvt Ltd 209/210 Arcadia, Nariman Point Bombay (Distt Aurangabad-Maharashtra)	12 3 85 (NU)	1 Black and-white TV sets 2 Audio tape recorder/player in combination	50,000 nos. 50,000 nos
Dinesh Baropalia 57 Banarsi Dass Estate Timarpur, Delhi (Distt Dehradun-UP)	12.3.85 (NU)	Colour TV receiver sets	50,000 nos.
Shiv Kumar Agarwal 4 Hunger Fort Street, Calcutta (Any permissible area near Howrah-West Bengal)	12.3 85 (NU)	Colour TV receiver sets	50,000 nos
S C Shah 12 Kailash Kiran No 2, Tilak Marg Ghatkopar (E) Bombay (Gandhinagar-Gujarat)	12 3 85 (NU)	Colour TV receivers	40,000 nos
R Ramachandran No 58, M R C. Nagar, Madras (Any permissible area in Tamil Nadu)	12 3 85 (NU)	1. Colour TV receivers 2. Black-and-white TV receivers	50,000 nos 50,000 nos
Manju Gupta 83 Anandlok, New Delhi (Distt Ghaziabad-UP)	12 3.85 (NU)	Colour TV receivers	50,000 nos
Rajendra Kumar 207/A Western Road Meerut Cantt, UP (Teh. and Distt Meerut-UP)	12 3.85 (NU)	Colour TV receivers	50,000 nos.
Ashwani Kumar H-1 Lajpat Nagar-III, New Delhi (Distt Mohindergarh-Haryana)	12.3.85 (NU)	Colour TV receivers	50,000 nos.

(1)	(2)	(3)	(4)
Andhra Pradesh Electronics Development Corpn Ltd Parisrama Bhavanam (8th Floor) Basheer Bagh Square Hyderabad (Distt Krishna-AP)	12 3 85 (NU)	Colour TV receiver sets	40,000 nos
R.K Agarwal Rangwala House, Sarafa Road Lashkar, Gwalior (Distt Bhind-MP)	12 3 85 (NU)	Colour television sets	50,000 nos
Vijay Krishan Lakbanpal W77A Greater Kailash New Delhi (Daman-Goa, Daman & Diu)	12 3 85 (NU)	Colour TV receivers	50,000 nos
The Investment Trust of India Ltd 117 Nungambakkam High Road Madras (Distt Chingleput Tamil Nadu)	12 3 85 (NA)	Colour TV receivers	50,000 nos
K. Vijay Vardhan Reddy Vijay Industries, 1 5 SIDCO Industrial Estate Kodungayur Madras (Any permissible area in Tamil Nadu)	12 3 85 (NU)	1 Colour TV receivers 2 Black and-white TV receivers	50,000 nos 50,000 nos
Udai Shankar Khandelwal 61/4 Ramjas Road, New Delhi (Himachal Pradesh)	12 3 85 (NU)	Colour TV receiver sets	50,000 nos
S C Chadha Plot No 9-10, R K Puram Officers Colony Secunderabad (Teh & Distt Madak AP)	12 3 85 (NU)	Colour TV receivers	25,000 nos
B B. Hattarki 25 Gajanan Housing Society Pune (Distt Aurangabad-Maharashtra)	12 3 85 (NU)	Colour TV receivers	50,000 nos
Rajeev Dand Gautam Niwas 548 Dr B A Road Matunga, Bombay (Any permissible area in the state of Maharashtra)	12 3 85 (NU)	Colour TV receiver sets	30,000 nos
Ananya Electronics Ltd B-429 New Friends Colony New Delhi (Distt Darjeeling West Bengal)	12 3 85 (NU)	Colour TV receivers	40,000 nos
Pramod Gupta B-15 Naraina Vihar, New Delhi (Distt Alwar-Rajasthan)	12 3 85 (NU)	Colour TV receivers	50,000 nos
Vivek Gupta 4 Friends Colony (W), New Delhi (Bangalore Karnataka)	12 3 85 (NU)	Colour TV receiver sets	50,000 nos
Kishore Kumar 11435 Shakti Nagar, G T Road New Delhi (Distt Ghaziabad-UP)	12 3 85 (NU)	Colour TV receiver sets	50,000 nos
Rajinder Prashad Near Muri Cinema Bhiwani Haryana (Distt Bhiwani-Haryana)	12 3 85 (NU)	1 Colour TV receiver sets 2 Black-and white TV receiver sets	50,000 nos 30,000 nos
Suresh Kumar 2204, Sector 15C Chandigarh (Distt Solan-HP)	12 3 85 (NU)	Colour TV receiver sets	50,000 nos
S K Garg F-137 Laxmi Nagar, Delhi (Any permissible area in Haryana)	12 3 85 (NU)	Colour TV receiver sets	30,000 nos
Madhya Pradesh Electronics Ltd Jyoti, 66 Nehru Place, New Delhi (Distt Raisen-MP)	12 3 85 (NU)	1 Colour TV receiver sets 2 Black-and-white TV receiver sets	50,000 nos 50,000 nos
O P Agarwal 16/881 Bapa Nagar Padam Singh Road, Karol Bagh New Delhi (Distt 24 Parganas-West Bengal)	12 3 85 (NU)	Colour TV receiver sets	50,000 nos
Parmod Kumar Agarwal 49-A Presidency Society N S Road No 7, J V B D Scheme Juhu, Bombay (Distt Pune-Maharashtra)	12 3 85 (NU)	Colour TV receiver sets	50,000 nos
L N Aggarwal K-46/188 Bisheshorganj Varanasi (Distt Jaunpur-UP)	12 3 85 (NU)	1 Colour TV receiver sets 2 Black-and-white TV receiver sets	50,000 nos 50,000 nos
Parveen Kumar 131 Inside Talaki Gate, Hissar Haryana (Distt Nainital-UP)	12.3 85 (NU)	Colour TV receivers	50,000 nos.
P K. Jain 3/12 Asaf Ali Road, New Delhi (Distt Ghaziabad-UP)	12 3.85 (NU)	Colour TV receiver sets	50,000 nos.
Vimal Mehta BN-85 (Paschimi) Shalimar Bagh, Delhi (Distt Ghaziabad-UP)	12.3 85 (NU)	1 Colour TV receiver sets 2 Black-and-white TV receiver sets	50,000 nos. 20,000 nos.
Rajendra Jain 1 New Palasia, Indore (Distt Dhar-MP)	12.3.85 (NU)	Colour TV receiver sets	25,000 nos.
Tasneem Rajkumar 45/3 Maneesh Nagar Andheri West, Bombay (Cat 'A' Backward Area in the state of MP)	12.3 85 (NU)	1 Colour TV receivers 2 Black-and-white TV receivers	25,000 nos. 20,000 nos.
Balwant Rai Gupta 135 Gujrawala Town (Part-II) Delhi Distt Alwar-Rajasthan)	12 3.85 (NU)	Colour TV receivers	50,000 nos.
S N Saraf 3-B Rajendra Park, Pusa Road New Delhi (Distt Alwar-Rajasthan)	12 3 85 (NU)	Colour TV receivers	50,000 nos
J M Kothary 'Kanta' Building, Little Gibbs Road, Malabar Hills, Bombay (Gandhinagar-Gujarat)	12 3 85 (NU)	Colour TV receivers	50,000 nos
Neo Export Pvt Ltd 204 Deepali, 92 Nehru Place New Delhi (Distt Ghaziabad-UP)	12.3 85 (NU)	1 Colour TV receivers 2. Black-and-white TV receivers	20,000 nos 30,000 nos.
Bengal Lamp and Electronics Ltd Royal Building (2nd Floor) Kadia Kui, Tilak Road Ahmedabad (Any permissible area near Bangalore)	12 3 85 (–)	Colour TV receiver sets.	20,000 nos
Milton Electronics Bunglow No 10, Opposite Old Secretariat, Bhopal (Distt Dhar MP)	12 3.85 (NU)	Colour TV receiver sets	50,000 nos
Systems Electronics & Computers Gurukripa-Urva 21-1-27 Kulur Ferry Road, Mangalore. (Distt Dakshina Kannada- Karnataka)	12 3 85 (NU)	Colour TV receiver sets	25,000 nos
Karnataka State Electronics Development Corpn Ltd 30 Race Course Road, Bangalore (Distt Bangalore-Karnataka)	12.3.85 (NU)	Process control instruments	Rs 100 million
R Vijay Kumar Vikram Enterprises, 87/92 New College Shopping Centre Peters Road, Madras (Any permissible area in the state of Tamil Nadu)	12 3.85 (NU)	1 Colour TV receivers 2 Black-and-white TV receiver sets	50,000 nos. 50,000 nos
Mohan Singh 2/89 Roop Nagar, Delhi (Kundli-Haryana)	12.3 85 (NU)	Colour TV receiver sets	50,000 nos
Ferrite India Ltd 16/17 Visvesvasya Industrial Estate, Whitefield Road Bangalore (At any permissible area near Bangalore-Karnataka)	12 3.85 (NU)	Colour TV receiver sets	25,000 nos.
Hindustan Reprographics Ltd Skyline House, 85 Nehru Place New Delhi (Distt Dehradun-UP)	12 3 85 (SE)	Plain paper copiers	3000 nos (after expn)
Infotech Ltd 3 Pycrofts Garden Road Nungambakkam, Madras (Distt Chingleput-Tamil Nadu)	15 3.85 (NU)	1. Minicomputer/ microprocessor based systems 2. CRT/data/display graphic terminals	Rs 60 million 5000 nos
Anil Batra 43-A Rajpur Road, Delhi (Distt Sonepat-Haryana)	15.3 85 (NU)	1 Deflection yokes for colour TV 2 Flyback transformers for colour TV	500,000 nos. 500,000 nos

(1)	(2)	(3)	(4)
Crompton Greaves Ltd 1 Dr V.B. Gandhi Marg, Bombay (Dehradun-UP)	15.3 85 (NU)	Process management and control systems	Rs 52 million in terms of value in the 5th year after commencement of commercial production
Sandur Electronics Controls & Automation Pvt Ltd Sandur House, 20 Palace Road Bangalore (Distt Bangalore-Karnataka)	15 3.85 (NU)	Data acquisition and monitoring system	50 nos
Ram Nath Sahni 215 Pennsylvania, Avenue Ithaka New York, USA (Distt Kullu-HP)	15 3 85 (NU)	CRT display terminals	500 nos
CRID Ltd Sardar Patel Hall Premises Bhubaneshwar (Distt Puri-Orissa)	15 3 85 (NU)	1 Proof encoders (MICR encoder) 2 Pass book printer 3 Minicomputer/ microprocessor based systems	3000 nos 1000 nos Rs 60 million in terms of value
Essel Industries 301-302 Padma Tower-1, 5 Rajindra Place, New Delhi (Any permissible area near Bangalore-Karnataka)	15 3 85 (NU)	Telephones	200,000 nos
Unirex Moulds Pvt Ltd A 208 Okhla Industrial Area Phase-1 New Delhi (Distt Bulandshahr-UP)	15 3 85 (NA)	Telephones	
Serval India Pvt Ltd C-34 Friends Colony, New Delhi (Permissible area in the state of UP)	15 3 85 (NU)	Telephones	200,000 nos
Superphone Communication Pvt Ltd 18-A Mama Parmanand Marg Opera House, Bombay (Any permissible area in the state of Maharashtra)	15 3 85 (NU)	EPABX (Electronic private automatic branch exchanges)	50,000 lines
Usha Computers & Peripherals Ltd 112-A Chiranjiv Tower 43 Nehru Place, New Delhi (Distt Gurgaon-Haryana)	15 3 85 (NA)	Electronic PABX	50,000 lines
Rishi Electronics Ltd B-319 Okhla Industrial Area Phase-1, New Delhi (Any permissible area in the vicinity of Delhi)	15 3 84 (NU)	EPABX	50,000 lines
Delton Cables Ltd 24 Bharat Ram Road, Daryaganj New Delhi (Distt Mohindergarh-Haryana)	15 3 85 (NA)	EPABX	50,000 lines
H R Vaish S-19 Panchshila Park, New Delhi (Any permissible area in HP)	15 3 85 (NU)	Telephones	200,000 nos
Fusebase Eltoro Pvt Ltd 16 Community Centre New Friends Colony, New Delhi (Distt Ghaziabad-UP)	15 3 85 (NA)	Telephones	100,000 nos
Lakshmi Enterprises 58 Nallanna Madali Street Madras (Union territory of Pondicherry)	15 3 85 (NU)	Colour TV receiver sets	50,000 sets
Magnum International Trading Corpn Ltd 48/1 Commercial Centre Malcha Marg, Chanakyapuri New Delhi (Ropar-Punjab)	15 3.85 (NU)	Telephones	200,000 nos
B.S. Ashok 44 Race Course Road, Bangalore. (Any permissible area in Karnataka)	15.3 85 (NU)	Telephones	200,000 nos
Jamuna Gases Ltd Aggarwal House 4/14-A Asaf Ali Road, New Delhi (Any permissible area in J&K)	15.3 85 (NU)	Telephones	200,000 nos
Naresh Bansal E-19 Greater Kailash-I New Delhi. (Any permissible area in Haryana or UP)	15.3.85 (NU)	Telephones	200,000 nos

(1)	(2)	(3)	
N.S Ravindran 86 Mowbray's Road, Madras (Any permissible area in Tamil Nadu)	15 3 85 (NU)	Telephones	200,000 nos.
Suneel Sardana H-32 Green Park Extension New Delhi (Distt Sirmur-HP)	15 3 85 (NU)	Colour TV receiver sets	30,000 nos
D K Khaitan E-24 Saket New Delhi (Teh Dadri Ghaziabad UP)	15 3 85 (NU)	Telephones	
Chrome Electronics Pvt Ltd Harilela House, 3rd Floor Mint Road, Bombay (Distt Panchmahal-Gujarat)	15 3 85 (NA)	Telephones	
ITC (India) Manufacturing Co Ltd Hongkong House 31 Dalhousie Square (South) Calcutta (Distt Dehradun-UP)	15 3 85 (NA)	Telephones	
Shree Jaisal Chemicals Ltd Imliwala Building K G B KA-Rasta Johri Bazar, Jaipur (Distt Bhilwara Rajasthan)	15 3 85 (NU)	Telephones	200,000 nos
Nitin Goel C-II/22 Tilak Marg, New Delhi (Any permissible area in the state of Rajasthan)	15 3 85 (NU)	Telephones	200,000 nos
United Telecoms Pvt Ltd McDowell House 3 Second Line Beach, Madras (Any permissible area in Bangalore-Karnataka)	15 3 85 (NU)	Telephones	
Sudhir Sood MS-II/11 Atul Grove Tolstoy Lane, Janpath New Delhi (Distt Solan HP)	15 3 85 ( )	Telephones	
Gopal Krishna Kejriwal 82/2 Cooperganj, Kanpur (Distt Ghaziabad-UP)	15 3.85 (NU)	Telephones	200,000 nos
O P Sachdev 7270-71 Old Rohtak Road Near Azad Market, Delhi (Any permissible area in UP)	15 3 85 (NU)	Telephones	200,000 nos
Star Glass Works 299 Mathuradas Vasanji Road Bombay (Distt Pune Maharashtra)	15 3 85 ( )	Telephones	
Rajit Electronics 502 Hemkunt Tower 98 Nehru Place New Delhi (Any permissible area in Ludhiana-Punjab)	15 3 85 (NU)	Telephones	
Prem Patro Patro's Lodge Sutahat, Cuttack. (Any permissible area in Bhubaneswar-Orissa)	15 3 85 (NU)	Telephones	15 000 nos
Peico Electronics & Electricals Ltd Shivsagar Estate, Block 'A' Dr Annie Besant Road, Worli Bombay (Outside Bangalore-Karnataka)	15 3 85 (NU)	Automated scientific instruments for analytical application employing spectroscopic and chromotagraphic techniques 1 UV/visible kinetic spectrophotometers 2 Double-beam UV/ visible scanning spectrophotometers 3 Atomic absorption spectrophotometers 4 Infrared spectrophotometers 5 Higher performance multiramping gas chromatographs 6 High pressure liquid chromatographs	800 nos
Manufacturing Technologies Inc 2026, Sector 21-C, Chandigarh (Any permissible location in HP)	16 3 85 (NU)	Telephone instruments	12 5 million nos

(1)

Binatone Electronics Pvt Ltd 58 B Sahibabad Industrial Area Site-IV Sahibabad (Distt Ghaziabad UP)	16 3 85 (NU)	Telephone instruments	200 000 nos
K K Joshi 414 New Delhi House 27 Barakhamba Road New Delhi (Any permissible area in Haryana	16 3 85 (NU)	Telephone Instruments	75,000 no
Pradip Kumar Agarwal K-101 Hauz Khas New Delhi (Any permissible area in Haryana	16 3 85 (NU)	Telephone instruments	200 000 nos
Weston Electronics Ltd 43 A Okhla Industrial Estate New Delhi (Distt Mahendergarh Punjab)	16 3 85 (NA)	Deflection components	240 000 sets
Giri D Khatod C/o 1203 Everest Chambers Mount Pleasant Road Bombay (Any permissible location in the state of Maharashtra)	16 3 85 (NU)	EPABX	50,000 lines
Parmod Kumar Aggarwal 49 A Presidency Society N S Road No 7, J V P D Scheme Juhu Bombay (Teh Lonavala Maharashtra)	20 3 85 NU)	Minicomputers microprocessor based system	Rs 60 milli
Haryana State Electronics Dev Corpn Ltd (Hartron) 1556, 18 D Chandigarh (Distt Hissar-Haryana)	20 3 85 (NU)	1 Grain analyser 2 Grain moisture meter 3 Soil moisture meter 4 Soil salinity test kit 5 Conductive meter 6 pH meter 7 Leaf area meter 8 Mobile agronics service units	100 nos 2000 nos 2000 nos 1000 nos 100 nos 1000 nos 100 nos 50 nos
Kamal Electronics and Engineering Ltd Plot No 901/6 GIDC Industrial Estate, Makarpura Baroda (Distt Baroda Gujarat)	20 3 85 (NA)	Microprocessor based energy saving and control system	Rs 30 million of ex-factory production value
C H Krishnamurthi Rao Titanium Equipment & Anode Mfg Co Ltd G S T Road Vandalur Madras (Distt South Arcot Tamil Nadu)	20 3 85 (NA)	Deflection yoke assembly including flyback transformers for colour TV receivers	
T N Krishna Iyer 8 Manoj Vidyanagari Marg Kalina, Bombay (Distt Thane Maharashtra)	21 3 85 (NU)	Electr[illegible] TV tuners	300,000 nos
Vishnu Dutt Village and P O Bada Brahman Distt Hisar, Haryana (Teh & Distt Hissar-Haryana)	23 3 85 (NU)	Colour projection TV	10 000 nos
Uptron Digital Systems Ltd Shri Pratap Bhawan Newal Kishore Road Lucknow (Distt Lucknow UP)	26 3 85 (NA)	Minicomputer micro processor based systems	Rs 60 million
Bharat Heavy Electricals Ltd Control Equipment Division Bangalore (Distt Bangalore Karnataka)	28 3 85 (NA)	Industrial robots	200 nos
Jammu & Kashmir State Industrial Development Corpn Ltd (SIDCO) Drabu House, Rambagh Srinagar (Distt Badgam-Jammu & Kashmir)	28 3 85 (NU)	Audio magnetic tapes (3 81 mm wide)	1100 MRM
Lalit Bhalotia 7 Maharaja Nand Kumar Road Calcutta (Distt Gandhinagar-Gujarat)	30 3 85 (NU)	Packaging, testing burning and programming of various types of integrated circuits in dual in line packages including brazed pin, ceramic dip plastic moulded etc	100 million chips
Continental Device India Ltd C 120 Naraina Industrial Area New Delhi (Delhi)	30 3 85 (NU)	Electronic tuners and operating units	500,000 nos each
Straw Products Ltd Nehru House 4 Bahadur Shah Zafar Marg, New Delhi (In the vicinity of Palam airport in the state of Haryana)	30 3 85 (NU)	Substrates for rigid disc media (plain and coated)	8 million nos

(3)

Prabhat K Andleigh C/o EA-45 Indrapuri, New Delhi (Distt Ghaziabad-Uttar Pradesh)	30 3 85 (NU)	Minicomputer/micro processor based systems	Rs 60 million
Lancer s Electronics 13 Abhaynagar, Opposite Navrang High School Road St Xavier's High School Road **Ahmedabad** (Daman-Goa, Daman & Diu)	30 3 85 (NA)	Colour television receiver sets	50,000 nos

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Name of Undertaken & Location	*IL dated*	
Elico Pvt Ltd B-17 Sanatnagar Indl Estate Hyderabad (Andhra Pradesh)	10 2 76	Professional grade switches
Ruttanshac International Rectifier Pvt Ltd Vikhroli, Bombay (Maharashtra)	21 9 77	High power silicon controllers rectifier etc

LETTERS OF INTENT CANCELLED

Sudhir Kumar A-12/6 Vasant Vihar, New Delhi (Uttar Pradesh)	27 2 84	Colour TV receivors
Electronics Corpn of Tamil Nadu Ltd Madras (Tamil Nadu)	31 12 83	Colour TV receivers
Chic Creation (India) Ltd New Delhi (Haryana)	9 3 84	Colour TV sets
Bihar State Pharmaceutical & Chemical Dev Corpn Ltd Patna (Bihar)	28 1 83	Soft and hard ferrites
CFR Electronics King (P) Ltd New Delhi (Uttar Pradesh)	21 8 82	Carbon/metal film resistors
Punjab Semiconductor Devices Ltd Chandigarh (Punjab)	26.3 81	Power diodes and power transistors
United Electrical Industries Ltd Kerala (Kerala)	8 3 83	Carbon film resistors
Meco-Vision Madras (Tamil Nadu)	28 2 84	Black-and-white/colour TV receiver sets
Tamil Nadu Industrial Development Corpn Ltd Madras (Tamil Nadu)	3 2 84	**Floppy discs**

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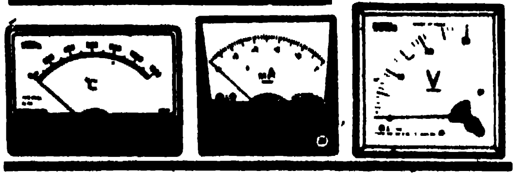

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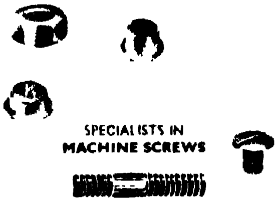

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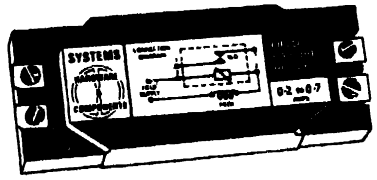

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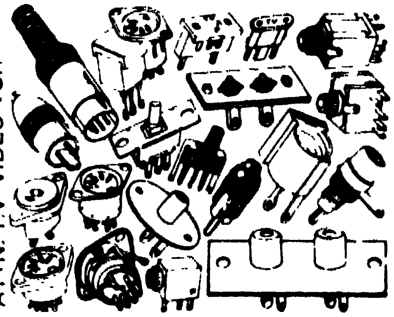

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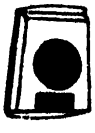

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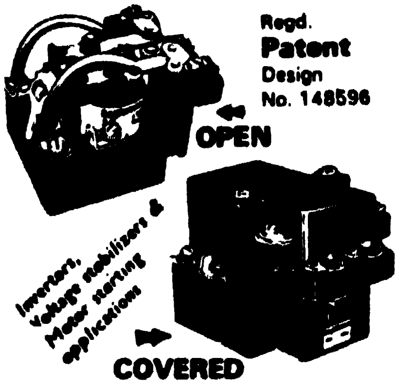
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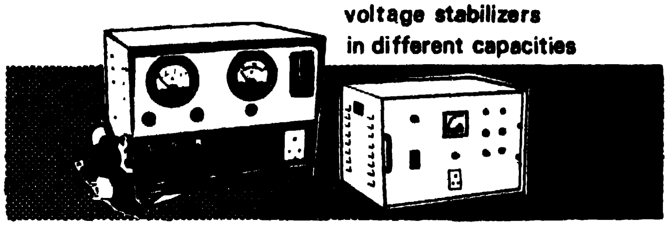

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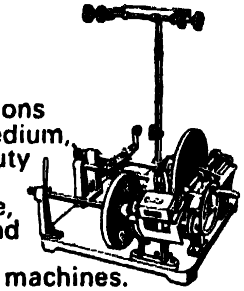

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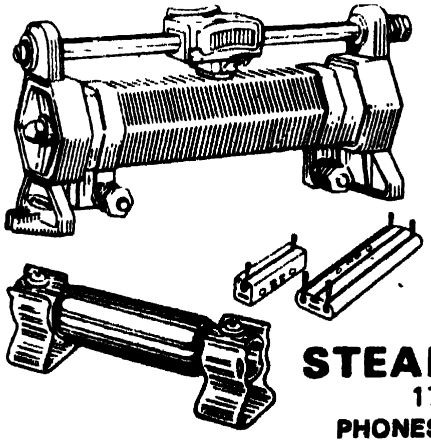

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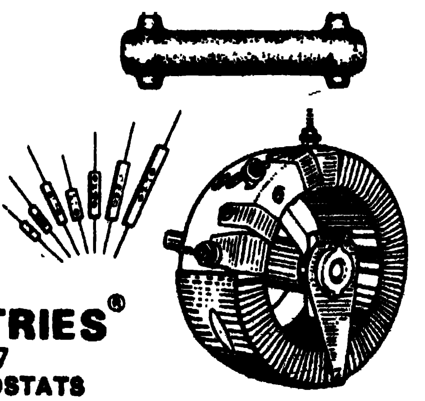

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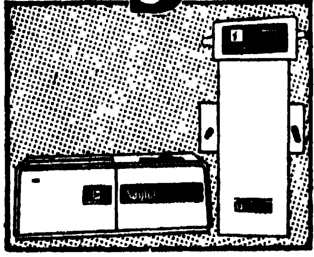

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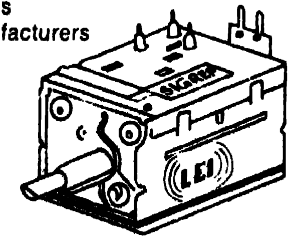

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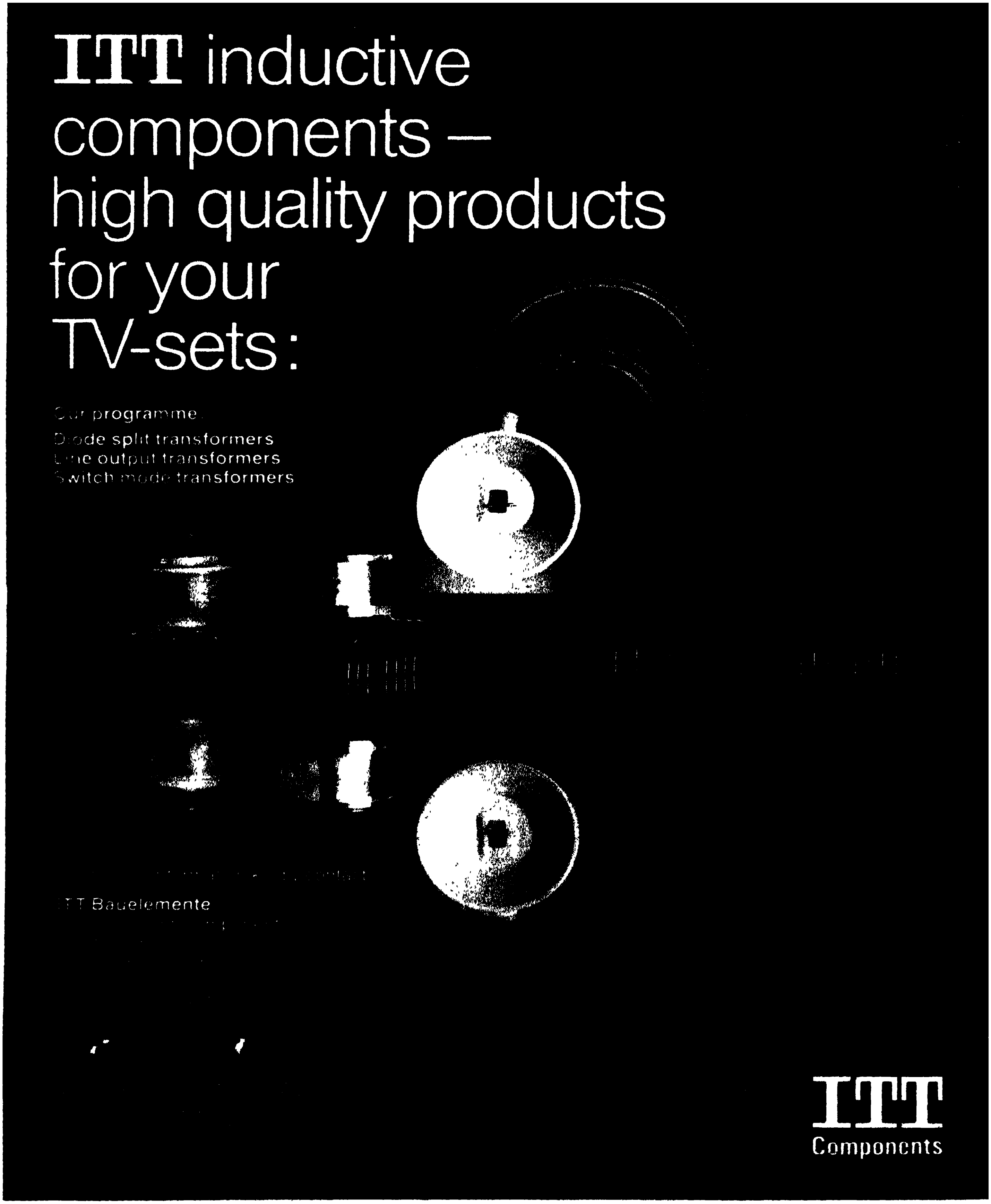

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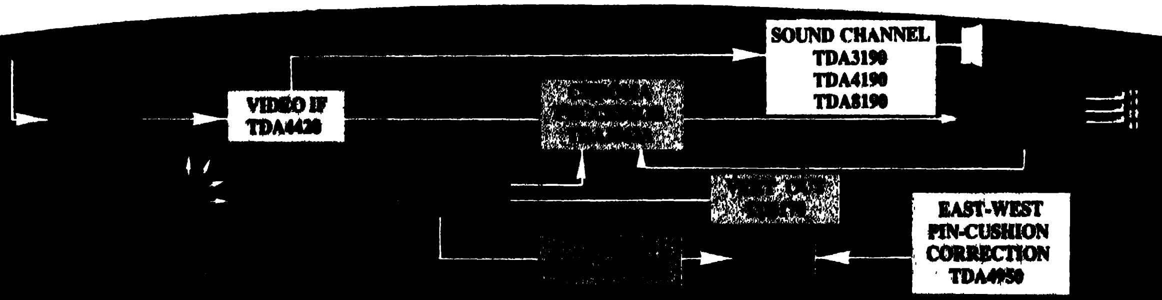

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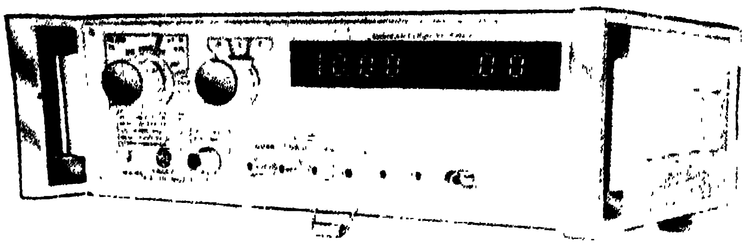

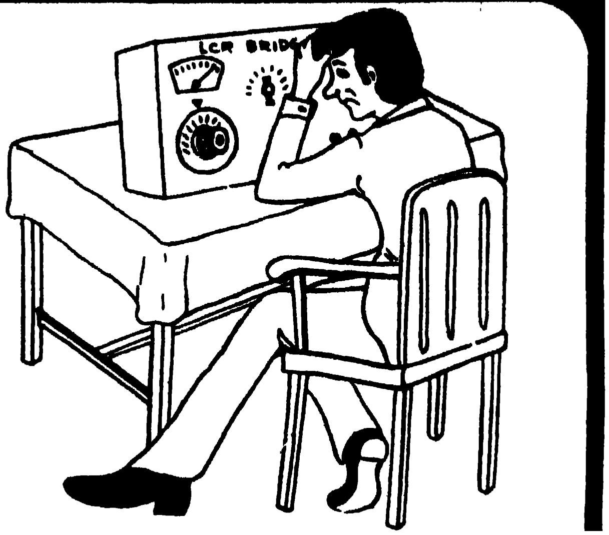

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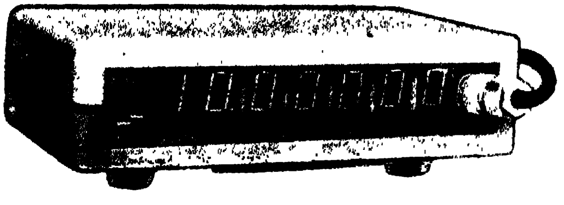

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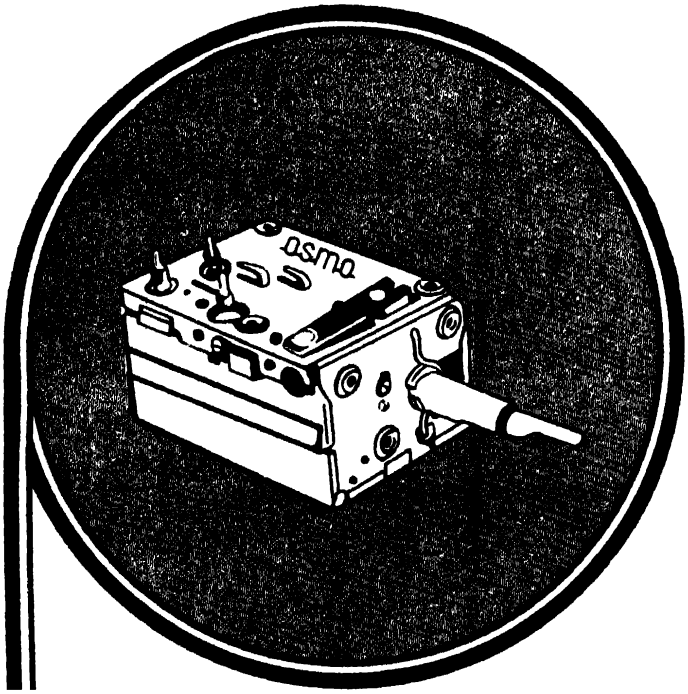

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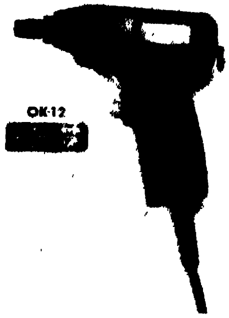

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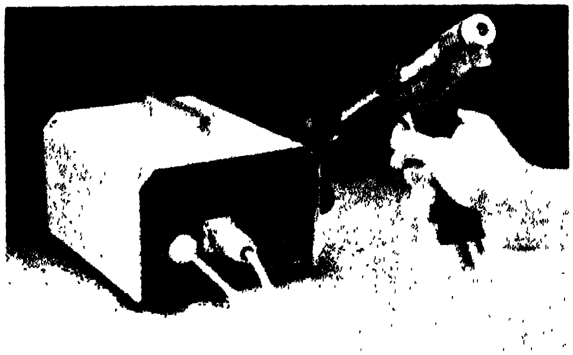

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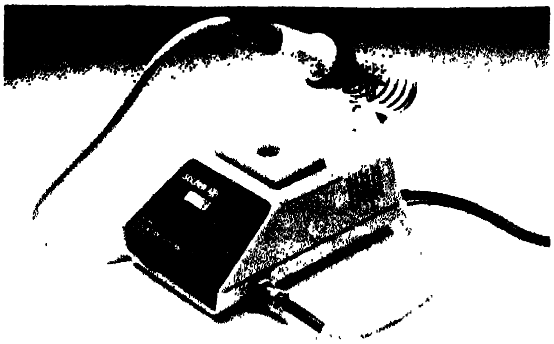

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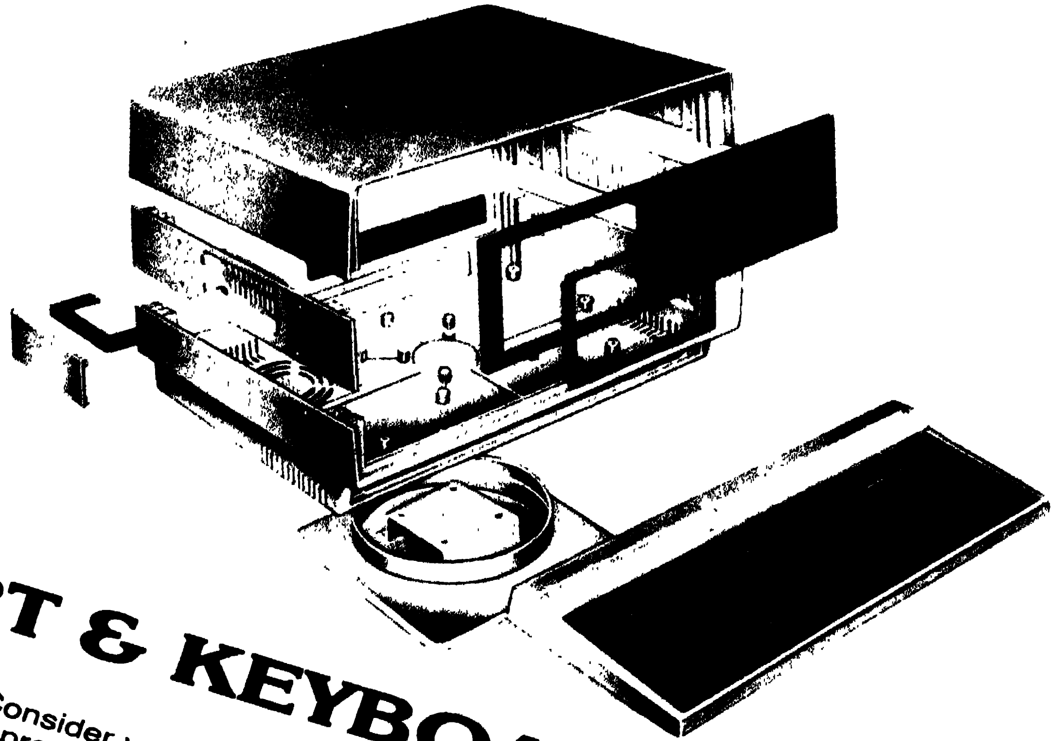

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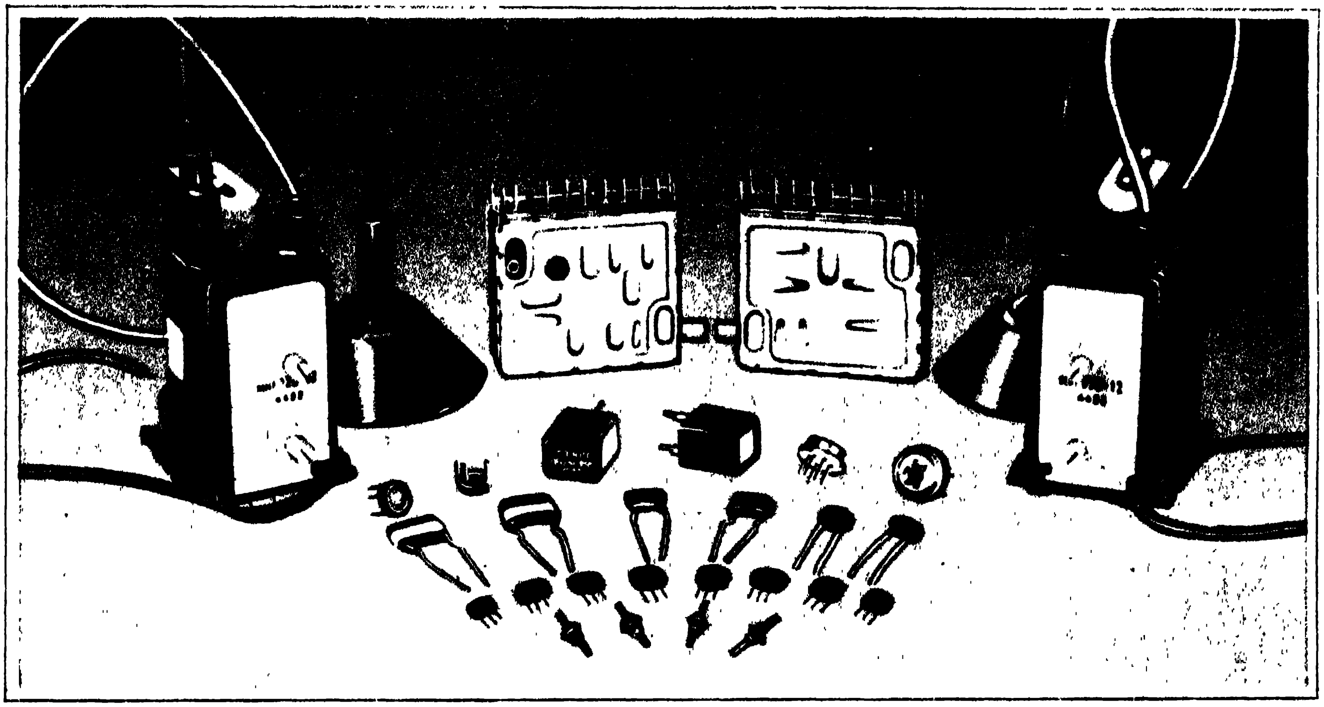

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Tryst with Teletext

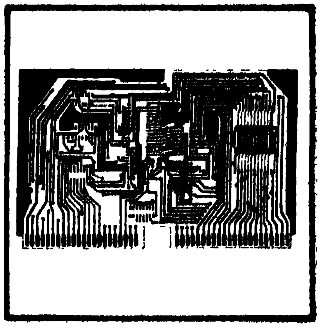
18 India's tryst with teletext started on November 14, 1985. Even after one month of its introduction, the basic principle of teletext remains largely unintelligible to many. The two articles in this special feature will serve to make the concept of teletext clearer to the readers.

Sound Shaping in Hi-Fi

37 The quality of sound reproduced by a hi-fi system is the result of many interacting factors like the reflection/absorption properties of the listening room, the sensitivity of the ear to different audio fequencies, etc. This article explains how to modify the hi-fi system to take these factors into account so as to get the best sound reproduction without sacrificing the originality.

—A.B. Sibal

Microprocessor Board



50 The 8088 microprocessor, an 8-bit version of the 16-bit 8086, has been gaining ground in the home-computers market abroad since 1982. While simplifying the hardware features, the 8088 retains the power of a 16-bit microprocessor. This powerful kit will make an interesting 'make yourself' project.

—K. Padmanabhan and S. Ananthi

An Intro to Teletext
—M. Sivaramaiah and B.V. Bajaj

An Insight into Teletext
—P.K. Subramanyam

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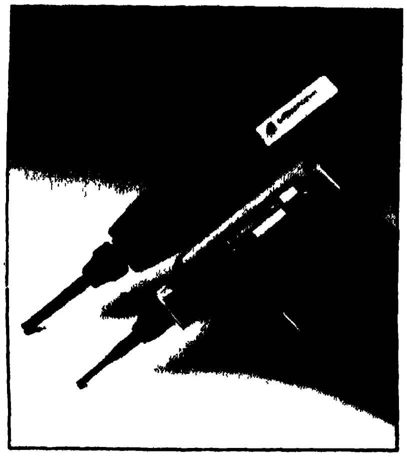

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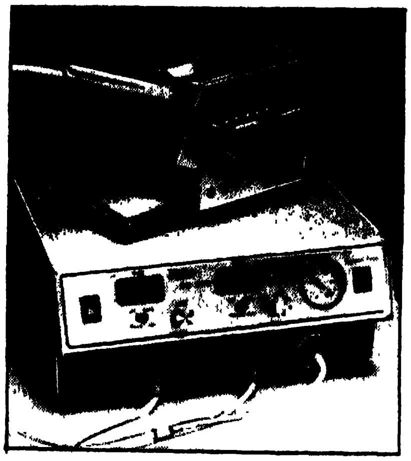

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KAVERI

Letters

FM Signal Generator

I would like to congratulate the author for his FM Signal Generator circuit published in August issue. However, I wish to point out some discrepancies in the article.

On page 73, in the second para under 'Tuning Procedure', C5 is the tuning capacitor for getting 800Hz tone and not C3. And there is a mis-match among the prototype, circuit diagram and the PCB layout shown. The EFY prototype and PCB layout seem to match with each other, as they both suggest individual AF and RF sockets with an RF OFF switch. But in the circuit diagram only one socket is shown for AF/RF output with a selector switch.

H.M. MARUTHI RAYKAR
Bhadravati

The author, Mr Arup Kumar Sen, replies:
Mr Raykar's observations are indeed correct C3 in text should have been replaced with C5. The discrepancy between the prototype and circuit arose because of a modification I had to carry out in prototype because of non-availability of multichannel switch S1 with me at that time. In all other respects the circuit, the PCB and the prototype are compatible.

TV DX Reports

Without using any TV signal amplifier and specific antenna, I receive a few stations from abroad as well as from our country which are thousands of kilometres from my receiver.

On 24th April, at about 7 45 am I received a Chinese telecast on channel 2 (identified from the test card). The picture was every poor with lot of fluctuation. I could not get the sound and the colour too was absent It lasted for about 45 minutes, and then vanished. Since then I have received this station with one more Chinese telecast on channel 3. Sometimes the incoming signal is so strong that the picture is very clear and lasts for hours. Unfortunately, I can't get the sound and the colour is also quite faded

The other stations I receive are Rangoon—when received, it has clear picture as well as sounding; Delhi-2 channel and Lucknow.

I am using an ordinary 3-element, channel-6 antenna which I made myself. The height of the mast supporting the antenna is about 10 metres from the ground with a slight upward tilt of 5°-10°. It is positioned towards the Imphal transmitter. Sometimes I change the direction of the antenna but there is no improvement in the picture with this.

BISWAJIT
Imphal

□ I have been getting TV signals from China on channel 2 here in Kanpur. These signals usually appear at 3.30 pm or 4.30 pm every day but fade away frequently when there are lot of clouds in the sky.

From 3.30 pm to 5.30 pm an educational programme is transmitted by the Chinese station. If ever you get it on the screen, you will observe a big black board on which Chinese alphabets are written and a lady teacher with a big stick sitting in front of it.

At 5.30 pm, news is transmitted in Chinese language and then some recreation programme is transmitted. Once I saw a Charlie Chaplin comedy film for about half an hour and then the signal faded away. Usually, after 7.30 pm, I am unable to get the signal Often only sound is received and video signals are found missing

From 5 30 or 6.30 pm a very faint signal appears on channel 3. The video signal is not very clear but the language, sounds somewhat like English – but not the kind we speak! Till now I have been unable to recognise the station but hope to do so soon.

I will give more details concerning TV Dxing in my next letter.

UMESH KUMAR
Kanpur

□ Please allow me to describe a freak transmission that I received on my TV on 11th July at about 4.00 pm The transmission was received with a 7-element, channel-8 antenna, without any booster.

There was some play going on whose language I could not follow The characters resembled Chinese features, while the dress they wore was of Mongolian type. The play was interspersed with commercials every 15 minutes or so. Among the commercials there were, 'Johnson & Johnson' baby powder, 'Bata' shoes, detergents, toothbrush etc. The symbol③with strange writing below often appeared on the screen, which I assume was meant for station identification. The signals, both audio and video, were quite distinct and came on channel 3. Two types of languages appeared—one was Chinese characters written vertically, and the second looked something like " ลกับ........", written horizontally Another symbol, a muscular man wearing trousers and shooting an arrow, with some Japanese type characters, appeared on the screen.

A few interesting points which I noted were: First, the play ended at 4.30 pm which was followed by names of artistes in Chinese, written horizontally. Second, a cartoon film lasting about two minutes showed how to dispose of refuse. There was another film showing people working in offices, factories etc, followed by a map of some country with money piling up on it. Perhaps the film was meant to urge people to be more producitve so that the nation's economic condition could improve. The third interesting point to be noted was that, a gentleman on entering his office greeted a lady with folded hands, similar to Indian 'namaste'. This was shown twice.

The play was followed by commercials, and the caption 'Silver Spoons' came on the screen in English. The names of artistes were also in English. Pictures of Buddha and temples also came on the screen with a voice in their language.

The reception lasted little more than half an hour after which both the audio and video signals faded gradually. I again received some transmission on channel 3 at about 8.20 am on 14th July, most probably the same station Only the video signals were received. The images were quite faint. There was some war or detective movie going on It showed soldiers moving in a jungle They killed somebody which was seen by a small boy who ran away in fright The characters had Chinese features. The reception lasted for about five minutes.

It was for the first time that I had received a foreign transmission on my TV Incidentally, it is to be noted that on both occasions, the sky was overcast and it was raining.

Could you or any of your readers enlighten me about the origin of the transmission?

S. MUKHERJEE
'Rangeet
Sarat Bose Road
Siliguri 434401

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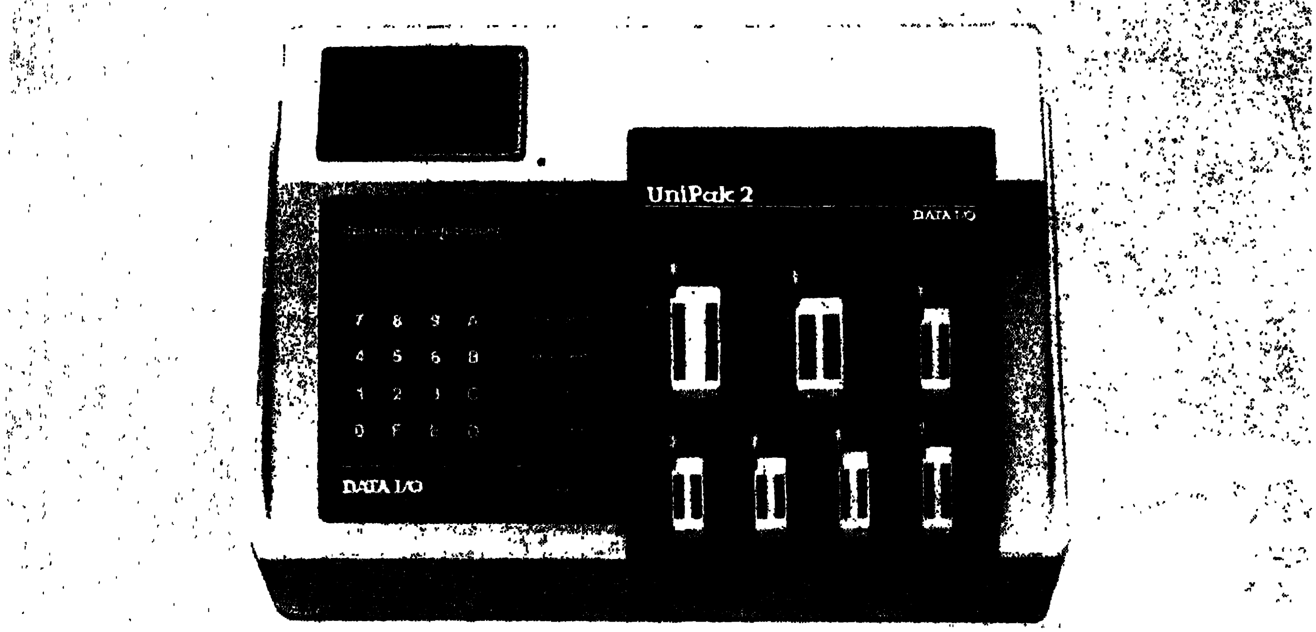

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IN INDIA.

Crash computer training programmes

The centre has advised all state governments to initiate crash training programmes to make available trained technicians for the computer and electronics industries. This is consequent upon the government's realisation that India is heading for a severe shortage of skilled manpower in these vital sectors.

It is projected that by 1990, trained technicians would be in short supply to the extent of nearly 115,200 persons

Disclosing this at a meeting in New Delhi, Mr Shivraj V. Patil minister of state for Electronics said the production target of Rs 100,000 million for electronics goods by 1990 could not be achieved if steps are not taken to increase trained manpower.

To meet the demand, the Electronics Commission has decided to start centres for training at Srinagar, Aurangabad and Imphal. Here, about 30-40 postgraduates and 100-200 short-term trainees would be trained every year.

The Department of Electronics is taking steps to introduce university-level electronics courses and new programmes for training junior technicians in ITIs in 100 districts.

Steep rise in production of electronics goods

The growth rate of production of electronics goods in the country increased drastically from 12.9 per cent in 1983 to 39 per cent in 1984.

Encouraged by this leap in production, the government has set an ambitious production target of Rs 26,360 million for the year 1985-86 and has taken several steps to achieve the projected targets.

Among the various steps taken by the government to formulate a new promotional policy to accelerate the growth of electronics in the country are: (a) a general liberalisation of licensing policy with emphasis on promotion rather than on regulation; (b) resorting to fiscal controls, in preference to physical controls, where controls are unavoidable; (c) removing the ceiling on capacity and restrictions of sectoral nature like large scale, small scale, private sector, public sector, etc, except where specific reservations are made; and (d) volume production at the economic level, with contemporary technology.

Second TV channel for Calcutta next year

The planning commission has sanctioned the introduction of a second TV channel in Calcutta.

Giving this information at a meeting in Calcutta, Mr V.N. Gadgil, union minister of state for Information and Broadcasting said for starting a second channel, a transmitter has to be installed. This transmitter would be set up in 1986 and the second channel would be operational the same year.

The planning commission has also sanctioned the setting up of local radio stations on frequency modulation technology in a number of states during the seventh Plan.

The minister ruled out any role for private sector in the operation of second channel in the country and also any possibility to introduce second channel in cities other than the four metropolitan cities before 1990.

Rs 4.3 million worth orders on Indian electronic firms

Indian electronics firms have bagged orders worth Rs 4.3 million for supply of components like semiconductors, micromotors, resistors, connectors etc. The orders were secured during the course of their participation in the world famous electronic show at Paris, "Salon International Des Composants Electroniques 85", held in November.

Trade enquiries valued at Rs 13.6 million were generated for items like toggle switches, test and measuring instruments, inverters, numerical control and automatic testing equipment, active components, passive components, floppy disc, CIS memories, semiconductors and resistors. The buyers who evinced interest in Indian products represented countries like France, the UK, West Germany, Italy, Austria, Czechoslovakia, Hungary and Spain.

The Trade Development Authority (TDA) organised the participation of nine Indian firms in the fair.

Interestingly, a large number of Spanish buyers showed great interest in the Indian electronic components More than 1200 visitors from various countries visited the TDA stand. The presence of numerous Spanish buyers was stated to be the result of Spain having emerged in recent months as a potential venue for setting up assembly units to meet the requirements of the west European countries.

In addition to encouraging export prospects of electronic components, Indian firms also received several tie-up proposals and agency agreement offers for distributorship.

Government's computers hardware factory

The government has decided to buy technology in the filed of computer hardware manufacture to set up a factory in the public sector.

Announcing this in parliament, Mr Shivraj V. Patil, minister of state for Electronics, said the government is negotiating with two foreign parties, one from USA and the other from France, for the purchase of knowhow for the manufacture of mainframe computer systems. The manufacture will be initiated by the Electronics Corporation of India Limited (ECIL) at Hyderabad. Answering a question, he said up to October, 1985, about 100 companies had been given letters of intent or industrial licences and about 200 companies had been given small scale approvals for the manufacture of computers, including minicomputers or microprocessor-based systems. Out of these about 70 companies have reported a total production worth about Rs 900 million during the calendar year 1984.

IETE technical convention in capital

The Institution of Electronics and Telecommunication Engineers (IETE) will hold its 29th technical convention as part of the 32nd annual general meeting in New Delhi from January 11 to 13.

Invited and contributed papers on communication; computer and control; office automation; circuits, systems and devices; instrumentation and measurement and electromagnetics will be presented during the convention.

The institute will also organise an exhibition to highlight India's progress in the field of electronics and telecommunication. The exhibition will relate to technologies in telecommunication equipment, instrument, components, consumer electronics and defence systems with a view to updating the industry's knowledge of latest developments in the field.

Over 400 licences issued for CTV manufacture

Over 400 licences have been issued by the government in various parts of the country for manufacture of colour TV sets

Forty-nine of these licences were issued in the large-scale sector and out of these 17 units have reported production The details of the TV sets produced by these companies during the period 1984 and 1985 (January to June) are given below

	Production	
Name of the Unit	*1984*	*1985*
Electronics Corporation of India Limited, Hyderabad	11361	17497
Uptron India Ltd, Lucknow	14587	12948
Bush India Ltd, Bombay	2944	Lockout since Sept
Konark Television Ltd, Bhubaneswar	8825	9099
Televista Electronics (P) Ltd, New Delhi	9688	5587
Dynavision Ltd, Madras	17643	11419
Video Electronics Pvt Ltd (Crown), Sahibabad	12095	6571
Electronic Consortium Pvt Ltd, New Delhi	13553	11535
Kerala State Electronics Development Corporation Ltd, Trivandrum	5692	14127
Television & Components (P) Ltd, Ahmedabad	14863	16791
BPL India Ltd, Bangalore	1415	8069
BPL India Ltd, Palghat	2598	6548
WEBEL Television Ltd, Calcutta	2099	Not received
J&K Industrial Development Corporation Ltd, Srinagar	–	938
Raghunandan Electronics Ltd, Bangalore		1601
Binatone Electronics Ltd, Sahibabad	–	325
Cear India Multronics Ltd, New Delhi	–	91
Continental Device India Ltd, New Delhi	Production commenced in July, 85	
Total	1,14,230	1,23.146

Apart from these 49 companies in the large-scale sector, licenses for CTVs have been issued to nearly 400 companies in the small-scale sector also and 30 of them have already reported production.

ST cut on electronics goods in Maharashtra

Sales tax on all electronics goods being manufactured in Maharashtra has been heavily reduced from 15-20 per cent to four per cent with a view to boost the development of electronics industries in the state

As a result of the reduction in the sales tax, cameras, video players and recorders, watches, dictaphones, TV sets, electronic telephones, closed circuit television sets, electronic type writers, tape recorders, stereo hi-fi amplifiers etc would become cheaper

.AND ABROAD

Towards digital television

The CCIR (International Radio Consultative Committee) study groups 10 and 11, which met in Geneva in October 1985, took a major step forward in the development of digital television, by reaching an agreement on a single set of specifications for the digital video interfaces, and for recording digital television on magnetic tape.

The proposed CCIR recommendations open the door to the realisation of fully digital television production studios, since it will make it possible to interconnect freely, digital studio equipment by means of a single digital video interface signal, and by setting a single digital tape recording format to record, edit and exchange digital television programmes.

Experts believe the new digital television standards will open a new era of unequalled recording, editing and post-processing flexibility in the production of television programmes, and in the exchange of superior quality recorded programmes among broadcasters.

The proposed digital television recommendations are based on the digital video encoding standard adopted by the CCIR in 1982 as CCIR recommendation 601. This stipulates the use of digital component signals sampled at a sampling rate of 13.5 MHz for luminance, and 6.75 MHz for each of the two colour difference signals. Digital coding of component signals rather than conventional PAL, SECAM or NTSC composite signals, offers great benefits to broadcasters and programme producers since it allows almost unimpaired post-processing capability, special effects, electronic tricks and sophisticated picture manipulation of recorded signals with the same level of quality that would be achieved if they were performed live on the studio output signal.

If adopted by the XVI Plenary Assembly of the CCIR next May, these new digital television recommendations would offer the broadcasters complete freedom in the production of programmes, and excellent quality in the pictures so produced.

Siemens invests DM 400 million in microelectronics

Siemens is setting up two new projects—a design center for chips and a technology center—to further expand its Balanstrasse complex in Munich into the leading center for innovation in the field of microelectronics. The company has invested nearly DM400 million in these two projects.

In the design center, new logic circuits, in particular, devices in CMOS technology for a wide range of applications will be designed from 1987 onwards. Emphasis will be placed on custom circuits based on standard single cells which will be created using 'Venus', Siemens' own design system.

In the second project the technology hall, a mask center to produce masks of all technologies for use in chip manufacture in the various Siemens plants will be set up. Using state-of-the-art electron-beam plotters, masks with structure widths down to 0.5 micron will be produced at this center.

The technology hall will also contain a pilot production line for bipolar high-speed logic circuits, specially ECL gate arrays for computer CPUs and components for broadband ISDN switching systems.

'Africa Telecom' exhibition

The International Telecommunication Union (ITU) and the Kenya Posts and Telecommunications Corporation (KPTC) will jointly organise the 'Africa Telecom 86' from 16 to 23 September 1986 at the Kenyatta International Conference Centre, Nairobi, Kenya.

Africa Telecom 86 is the first major international specialised communications exhibition of the ITU World Telecommunication Forum on the African continent.

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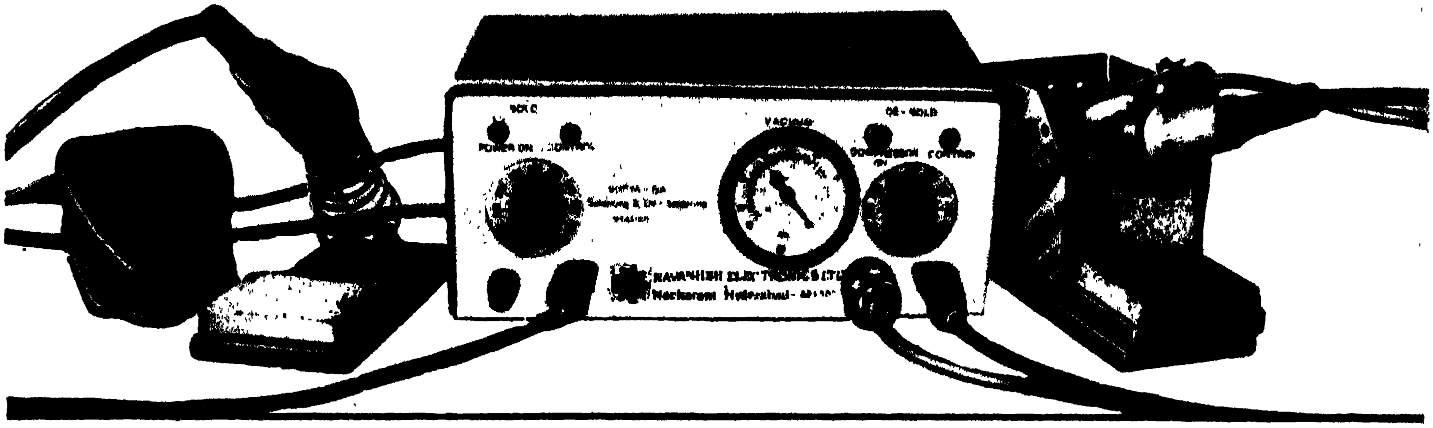

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Teletext Arrives

Teletext has arrived in India. After a long wait (it was first introduced in England in the early seventies), teletext descended on the Indian scene rather unnoticed, bereft of the fanfare it should rightly have attracted.

Christened Intext, teletext in India is presently limited in its service to only residents of New Delhi. It is now being transmitted on channel-7 from 9am to 11pm with a one-and-a-quarter-hour break from 2.45pm to 4pm. It can be received within a radius of 15 kms from the transmitter.

However, there is no such tangible limitation on the usefulness of teletext. From rail timings to news details to stock exchange rates, information can be displayed on the TV screen in a jiffy. Yet, these are only a few of the many wonders that can be worked with teletext. So, it seems reasonable to believe that teletext can revolutionise the information techniques in the country... that is, provided the common man can afford the extra costs incurred.

For whatever reason, the 'information revolution' has yet to materialise. More than one month has passed since its introduction but the term 'teletext' is still alien to many in Delhi and to most outside the capital. It is probably too early for judging its effectiveness and may be Intext will yet make the grade. But one important factor that threatens to stall the progress of Intext is the cost of the decoder, which happens to be prohibitively high at present.

Initially, it was made out that the decoder would cost only around Rs 1500. As often happens, this turned out to be a gross underestimation. It is clear now that the decoder will not cost less than Rs 3000. In fact, it may cost Rs 4000 plus. Add to this the cost of procuring a colour TV (black-and-white sets are useless for receiving teletext signals as of now). And the long and short of it will be that teletext is out of reach of most of the Indians, for whom even owning a colour TV is a luxury.

The reason for the high cost of the decoder is that it is not being manufactured in India. The ET&T has imported a batch of decoders from France and these are being marketed through select manufacturers—ECIL, Uptron, Weston, Texla and Dyanora, to name a few.

ECIL has sold about 100 decoders to Doordarshan but is yet to start direct sales to individuals. Some bookings have been made and the company hopes to start direct sales soon. Texla has undertaken to market 100 TV sets with decoders on an experimental basis and is making some necessary modification to the existing sets. So are most others. Even the colour TVs already sold need this modification. Uptron, however, claims that its CTVs, sold and unsold, need no modification.

Texla has priced the decoders at Rs 3000, ECIL at around Rs 4000 and Uptron at Rs 4200. It is not clear why such differences in costs should exist when the decoders are being procured from the same source!

Apart from the cost, another factor that seems to have had a bearing on the people's disposition towards Intext is the fact that the usefulness of teletext has not been precisely defined. Many still believe that teletext is designed to serve the needs of businessmen. Nothing can be more grossly wrong. Uses of teletext are manifold. News details, rail and air timings etc are only few of these.

In Britain, for example, about 50 pages of a popular novel are transmitted continuously throughout the day so that one can read books at leisure, without much effort and expenditure. In France, teletext has forced bulky telephone directories nearly into oblivion. One has only to tap the name of a particular person on a specially provided keypad and the telephone numbers and addresses of all the persons of that name are displayed on the screen from which one can find the number of the person desired.

Intext also has demonstrated the usefulness of teletext. Recently, when there was a major gas leak in the capital, together with the news, Intext flashed a set of first-aid measures for gas-affected persons. This may not be a major achievement in itself (as few had the decoders to receive) but is certainly a pointer to how teletext can be useful at crucial times.

Sub-titling is another important use of teletext. Specially, for a multilingual country like India, TV programmes of a particular language can be made more interesting and meaningful to others speaking a different language.

It might take years for Intext to reach such sophisticated levels of usage. But now that it has come to India, we can afford to wait a little longer.

The French ANTIOPE system has been adapted for use in India. ANTIOPE is an acronym for Acquisition Numerique et Televisualisation d' Images en pages d' Ecriture, meaning, digital acquisition and visual display of pictures as pages of lettering.

The principle of working of teletext is as obscure to many as its importance. The following two articles in this special feature on teletext, though largely based on the British systems of CEEFAX and ORACLE, will give a good idea of the basic principles that are common

M. Sivaramaiah and B.V. Bajaj

An Intro to Teletext

Teletext is a system by which text data can be transmitted along the normal television picture signals. A viewer can select any of the text data to be displayed on television screen by using a suitable decoder instrument. This article explains the principle of operation of teletext service, the international standards presently in use and introduces the standard hardware manufacturers.

The basic idea of transmitting the printed text data over telephone cables or by radio links using various electronic instruments, viz, telegram, telex, newspaper print, is not new. This facility has been largely used by business houses, press agencies, stock exchanges etc. But this type of system could not readily be used at home. The advent of large scale integrated circuits (LSIs) during early seventies and the widespread use of television as popular mass media have now led to the use of teletext service at homes, offices and business houses. The television receiver can now also be used for display of text with some additional circuitry. All advanced countries are having this service on their regular TV telecast.

The work on teletext began around 1973 in Britain, using coding techniques for transmission of text data with television. Two major British organisations developed their own coding techniques and started the teletext service. The British Broadcasting Corporation's (BBC's) teletext service is called CEEFAX (see facts) and the other service offered by IBA is called ORACLE (Optional Reception of Announcements by Coded Line Electronics). Both the services provide the viewer, equipped with the necessary teletext receiver, with additional information relating to many subjects, simultaneously with the normal television programmes.

The teletext service for the public transmission needed some standards and to arrive at the standards, the best features of both the CEEFAX and ORACLE were incorporated, some new features added and common standards for the transmission drawn up in 1974. Today, all the programmes broadcast in Britain carry teletext data as part of the transmission signal. Many countries have adopted the British Teletext Standard and a modified version of this has been tested in the USA. An alternative text system known as ANTIOPE was developed in France and is being used there and in some other countries. Canada has developed a text system called TELIDON which is likely to become the standard in North America.

It has been announced recently in Parliament by the minister of state for Information and Broadcasting, Mr V.N. Gadgil, that the teletext service introduced in Delhi on November 14,will be added to other major stations of Doordarshan. Doordarshan authorities in conjunction with ECIL, DoE and NIC have taken up the above project. The French system ANTIOPE has been adapted for use in India.

Definition

Teletext can be termed as a system for transmitting pulse coded signals during the field blanking interval of video signal which can be stored in the receiver and recalled on demand to display information in alphanumeric form or as graphic data. Invariably, a 3-digit page address (number) is used in all standard teletext services.

Teletext is a system by which data spread over 100 or more pages of text can be transmitted along with the normal television picture signals. A viewer who is watching the normal Doordarshan programmes will be completely unaware of these extra signals but by using a suitable decoder instrument, he can select any of the pages of the text being transmitted and can view the selected page on the TV screen in place of the normal programme.

How teletext works

Normally, television receivers display programme pictures. For teletext, the normal television receiver is fitted with additional circuitry to decode and display the teletext data. This circuitry has some controls to switch the TV receiver into next mode which brings the text display on screen. The decoder has buttons numbered 0 to 9 through which the pages of text can be selected.

The teletext can accommodate pages beginning from 100 to 899 (Doordarshan which has adapted the French ANTIOPE system uses pages from 1 to 100). The first page of text will display the index table, and after choosing the required page number, the particular page can be viewed on the screen. These pages carry a wide range of information available on screen like, news headlines, news details, news flash, travel news, financial headlines, financial news, sports headlines, sports news, TV and radio information, weather news and forecast, health and diet, cookery, education and a

---

M. Sivaramaiah, manager and B.V. Bajaj, senior technical officer, work in the Control Systems Group of Electronics Corporation of India Limited, Hyderabad

variety of other information.

Block diagrams of a typical television transmitter and receiver stages incorporating teletext facility are shown in Figs. 1 and 2. The organisation of teletext page and its features are explained first.

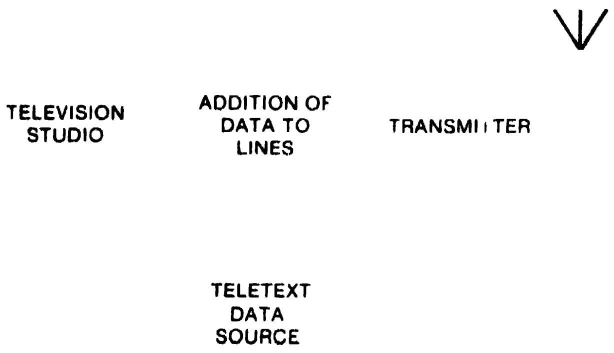

Fig. 1: Block diagram of a typical TV transmitter incorporating teletext facility.

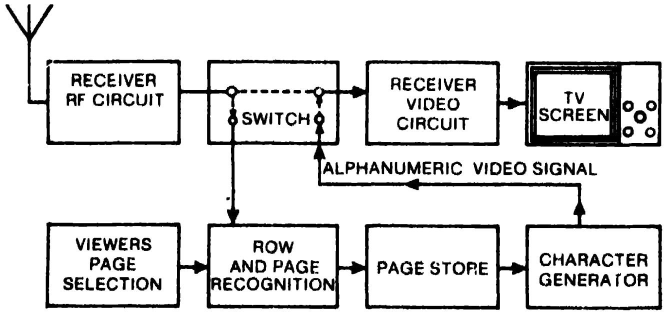

Fig. 2: Block diagram of typical TV receiver stages incorporating teletext facility.

Teletext page

Each teletext page consists of 25 rows and each row has 40 characters, giving a maximum of approximately 120 words on a page. The characters are displayed in a 7 × 5 matrix. The page information is transmitted continuously at a rate of about eight pages (four in case of Doordarshan) per second, i.e. a 100-page information is repeated every 12 to 15 seconds (every 20 seconds by Doordarshan). The normal access time between selecting a text page and having the earlier page disappear on the screen is 10 to 30 seconds, and depends on the total number of text pages being transmitted.

The displayed data can be presented in several forms:

(a) Text on a page can be presented in seven colours with the eighth colour for background.

(b) Part of the text may be made to flash on and off for emphasis.

(c) The text may be displayed with twice its normal height on the screen.

(d) Some part of the text may be blanked off until the viewer presses a reveal button to bring it into view (for quiz etc).

(e) Sub-titles may be provided for some viewers without affecting the picture.

Transmission of teletext signals

The television signal contains a frame blanking period in which no picture information is transmitted. As present receivers do not require such a long period, during this period additional information can be transmitted. Out of the 22 blank lines in each field, only four lines are used for teletext transmission (Doordarshan is using three lines and the number is variable). Hence, in a normally adjusted television receiver, the teletext data will not be visible since these signals occur while the scanning beam is outside the screen area.

The teletext data is a digital signal in which '0' level corresponds to the black level in the picture signal and '1' level is equivalent to about 66 per cent of the peak white signal. In each teletext line, 45 data bytes are transmitted (40 in case of Doordarshan). Each byte is of 8-bit length Seven bits define the character and one bit is for parity check. Of the 45 data bytes of each line of text, first five bytes of data are used for identification of the row and synchronisation of the decoder circuitry. The coding is basically through a 2-level non-return-to-zero data waveform.

The data rate to transmit 45 × 8 bits per scan line makes 6.9375 mega bits per second or the fundamental data frequency of 3.5 MHz which passes through the normal 5.5 MHz bandwidth of the television receiver. The bit rate is timed by a clock pulse whose synchronisation in the decoder is referenced to the peak of the penultimate '1' of a clock. Each page is headed by a 32-character page header which details about page number, data, time etc. So, when the viewer's selected page coincides with the page being transmitted, the information is displayed.

Reception of teletext

The teletext data is received in exactly the same way as the picture signal and as a part of the video signal. The video signal is then fed to a gate circuitry which separates out the data during the scan lines in which teletext data are expected.

The first three bytes of signal are used to synchronise the incoming data. The row data information is detected in the fourth and fifth bytes. The '0' row or header row is displayed on the top of the page and contains 32 characters of text. The remaining 8 characters are used to display page number, time and other control information.

Thus, to get a particular teletext page, the decoder examines all row '0' data lines and compares with the page code requested by the viewer. If it matches, then the teletext page information is stored in the memory. A complete teletext page needs 40 × 25 bytes of storage memory or 1k byte memory. This digital stored information of the desired teletext page is then used appropriately to display on TV screen.

There are 287 scan lines per field in a displayed picture. So, each row of text can have 10 scan lines and each scan line is divided into 40 equal width spaces with six dot spaces for each symbol. Thus, each symbol is displayed as 10 × 6 dots which represent the desired symbol of alphanumeric character.

The text data is read from the page memory as the scanning beam passes through each character space on the screen, and is fed to a ROM (Read Only Memory) to display the appropriate 10 × 6 dot patterns. As the scan moves down through the row of text, successive rows of dots are selected and after the ten scan lines for a row of text are complete, the data for next row of text is selected from the page stored in memory. This way, the process of making a full page is completed. This complete sequence is repeated 50 times a second to produce a text display on the screen.

Standard hardware

The first well-known manufacturer to produce teletext module (the XM11) was Texas Instruments. The decoding and display logic and page memory is built-in on this board. Mullard's Multitext system, GEC Semiconductors and General Instrument Microelectronics Limited are the other manufacturers of teletext decoders.

The teletext adapter unit receives the signals and decodes them to video signals which are fed to colour encoder and UHF modulator circuit of a television set to produce the text on the screen. The TV receiver has to be tuned to the UHF output signal frequency of the adapter. □

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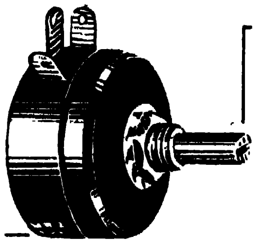

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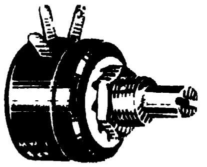

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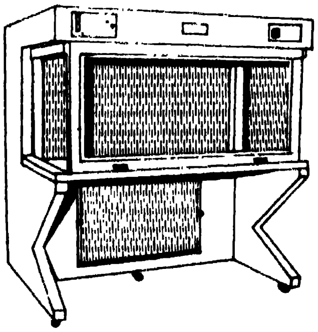

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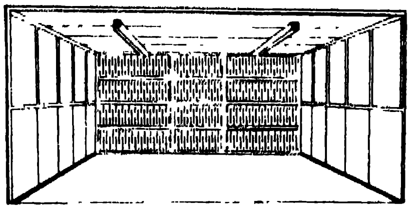

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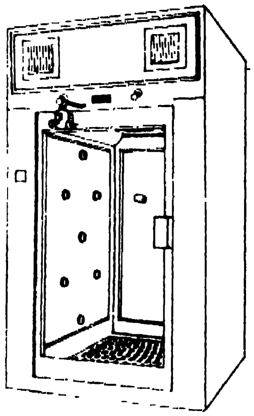

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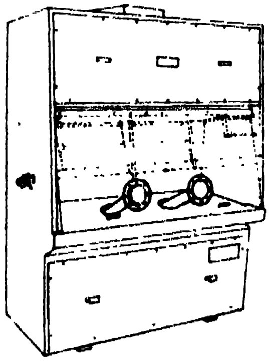

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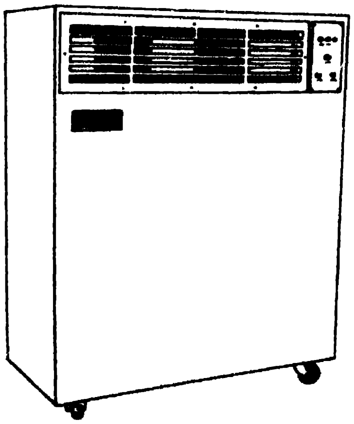

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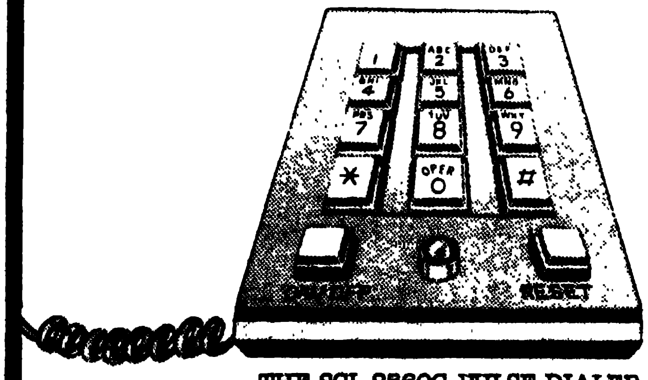

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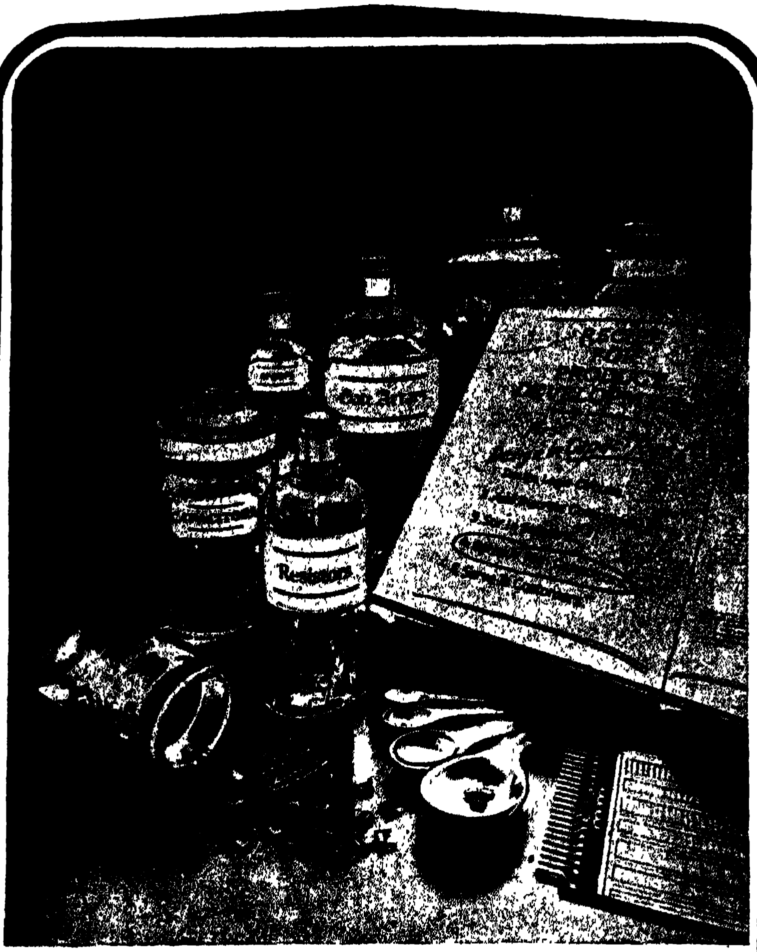

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An Insight Into Teletext

INTEXT: The Teletext Revolution

P.K. Subramanyam

Television was introduced in India in 1959 on an experimental basis and within a few years a regular service was also started. Thereafter, the single-channel operation spread to the metropolitan cities. The first revolutionary milestone was registered nearly a quarter century later when colour TV was introduced for the first time in 1982 for Asiad coverage. Initiated after a great deal of discussion and debate, the colour TV has now come to stay.

The second milestone was reached with the launching of INSAT-1B in 1983, opening the gates for nation-wide TV telecasts. The third milestone was crossed in 1984 with the installation of a national network of low power transmitters, bringing TV within the reach of 70 per cent of the population.

Doordarshan crossed the fourth milestone recently, when on November 14, 1985, prime minister Rajiv Gandhi inaugurated the teletext transmission, thus ushering in a new information revolution in the country.

What is teletext?

If a film on TV is interrupted for a news flash, this interruption occurs on all receivers covered by the transmitter. If a viewer wants to know the posts advertised by UPSC, he has to wait for the programme titled 'Rozgar Samachar'. For weather information, he has to wait till the end of the news bulletin. For knowing routine train and air timings, there is no arrangement on the TV at present.

But, with the advent of teletext (to be known as 'Intex' in India), the viewer becomes his own information controller. He has to spend only about Rs 2,000 on a teletext adaptor (decoder) and fit it to his TV set. The adaptor has a small switch and a calculator type keyboard. He has only to switch on the text mode and press a number on the keyboard, say 1, and the film on the screen is replaced by the index page of the teletext magazine being broadcast by the TV centre continuously.

A possible format for the page could be:

INTEXT DT. 2.12.1985
INDEX-PAGE 1

NEWS HEADLINES	2
NEWS DETAILS	3-15
SPORTS MEETS	16-20
FINANCE	21-30
AIR TIMINGS	50-56

Now, if the viewer presses two more buttons, say 51, he will get after a quarter of a second the detailed air timings like:

INTEXT DT. 2.12.1985
CONTENTS-PAGE 51

DEPARTURE	IC401	BARODA	1640
	IC403	MADRAS	1750
	IC407	BOMBAY	1800
ARRIVAL	IC411	CALCUTTA HOUR LATE	0915
	IC414	PATNA	1215

Information in a page

The information that can be crowded into a single page, i.e., on a full screen for comfortable viewing and clarity has been more or less standardised. Each row is expected to contain 40 characters,i.e., alphabets or numerals including spaces. There will be 25 rows. Hence 25×40, i.e., 1000 characters on each page. The characters are in Roman script and the numerals in international style.

How many pages?

The number of pages available depends on several factors, such as:

(a) The ability to collect and update information every hour.

(b) The capacity of the computer store. Modern computers can store more information than that can be carried in the entire TV signal. Hence, this is no problem. (In fact in another system operating through telephone lines called videotex, the computer is capable of providing thousands of pages with a very little access time)

(c) The ability to accommodate the information in the concealed portion of the TV signal. In some countries a big portion of the concealed signal is utilised, thus accommodating as many as 800 pages. These countries also have highly advanced information processing systems.

In India a start has been made with about 80 pages by using a small portion of the concealed signal. The waiting time in such a case (see calculations later in this article) is about quarter of a minute. In other words, after selecting the page on the keyboard, one may have to wait for a maximum of quarter second to get the page on the screen.

The teletext data is telecast continuously, though it is not visible on the normal TV set. Each page is repeated after about 20 seconds and stays only for a fraction of a second. Such a short time is, of course, not enough for reading. Hence a one-page memory is incorporated in the teletext decoder. Once the selector key is pressed, say 21, the decoder matches 21 with the page number of the text. As soon as that page comes, it is captured in decoder's memory and displayed on the screen. Thereafter, it continues on the screen as long as a viewer wants.

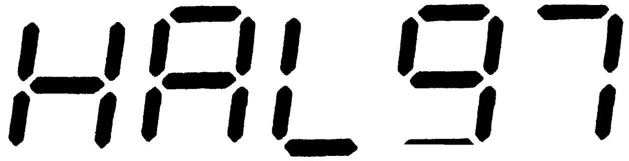
During the period of teletext display, the normal programme on TV will not be seen. (In most decoders there is provision for superimposition so that normal programme can also be monitored.)

The information supply to the computer is being arranged by the National Informatic Centre (NIC) of the Department of Electronics. Several organisations like PTI are likely to supply news directly to the computer. The data received via teleprinter or telephone or printed page can be loaded into the computer which retains the information in electronic form (as bytes). Thereafter, the information is passed on to the TV centre, also in electronic form, and reprocessed as alphabets by the decoder.

Let us now look at the various technical aspects involved in processing, transmitting, accessing and displaying the information.

A 7-segment display is capable of displaying not only numerals but also alphabets.

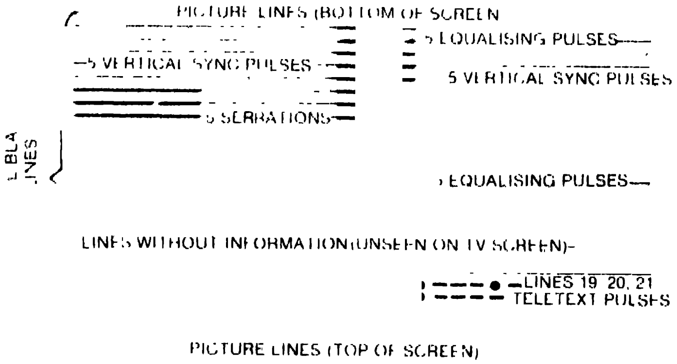
Take for instance:



With some modifications all the alphanumerals can be displayed. Theoretically, the seven segments can display 2^7 different symbols, i.e., 128 symbols. However, as per the ANSCI code there are only 96 alphanumeric characters to be displayed. Hence 7-segment approach is suitable for writing alphanumerals of the English language. What is needed is a dot generator which generates the appropriate dots on the TV screen to form the characters.

Gating of information

As already stated, the data is concealed in the signal from the viewer and the TV screen. But if the video signal is seen on an oscilloscope, it can easily be found where it is concealed. It can sometimes be seen even on the TV set. Adjust the vertical hold so that the picture starts rolling. You will see that between two pictures there is a dark band about 2 cms in width. Increase the brightness control. The band will become grey. Then you will find dark lines almost half the screen size in length and some small dark bits forming a hammer-head. These can be seen on any TV receiver. If the transmission contains teletext data, then you will also see sparkling white spots on three lines in the grey region.



The bright spots of teletext can be seen by all the viewers by this experiment. Only those with a teletext decoder can get the data decoded and obtain a full screen display of characters.

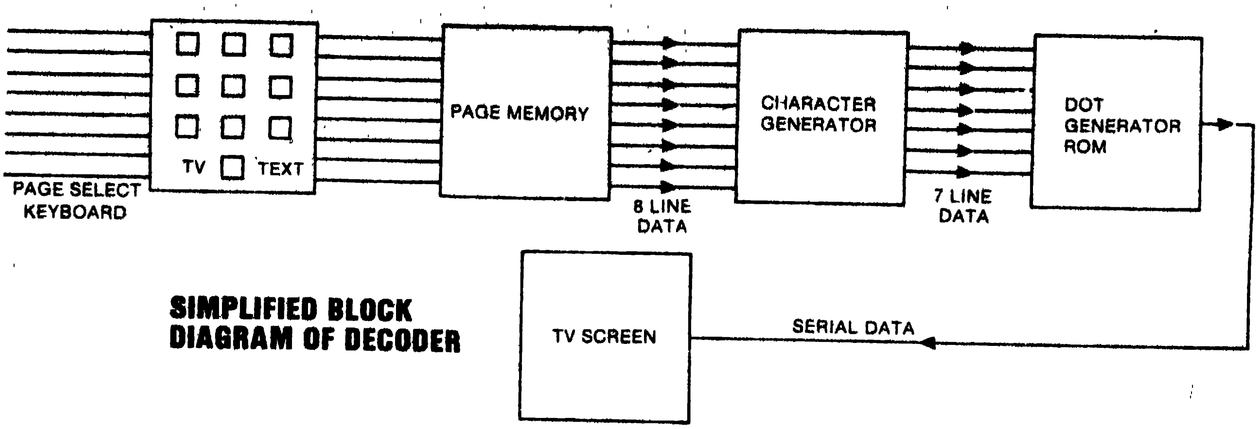
The dark band is known as the vertical blanking interval (VBI). During this period of 1.2 milliseconds, the beam, after reaching the end of the picture at the bottom, flies back to the top of the screen to start the picture again. During this period the beam is blanked out so that its flyback trace is not seen on the screen.

It is in this blank line periods that the text information is being packed. BBC/TV started with 2-line periods and expanded to a few more lines. 'Intext' will start with only three lines in each field in the first instance. The teletext adaptor will gate out this data and store in its memory.

Nature of data

In computer buses, data is usually expressed in bits (or in bytes consisting of eight bits each). One byte is also sometimes referred to as an 8-bit word. As 7-segment technique is used for presenting alphanumerics, seven bits are needed for each character. (Eighth bit is used as correction bit.) In other words, each alphabet is represented by a byte. Since each line has to accommodate 40 characters, there will be 40 bytes.

One interesting point is about the bit-rate. 360 bits × 625 lines × 25 pictures per second will give a bit rate of 5.8 million bits, i.e., 5.8 megabits. Since one black and one white can be taken as one cycle, this will give a cycle of 29 MHz. (Taking into account the horizontal blanking interval of 12 microse-



SIMPLIFIED BLOCK DIAGRAM OF DECODER

conds in addition to actual picture time of 52 microseconds, the actual bit-rate will be a little more, i.e., 3.5MHz. In any case, the video signal itself has a frequency band of 5 MHz and can easily accommodate this bit-rate.

Repetition rate

The television system's field repetition rate is 50 fields per second, i.e., 20 milliseconds. Each field contains data in two lines for two rows. For completing 25 rows of data, we will need 12.5 × 20 = 250 milliseconds. This means the data is being transmitted at the rate of four pages per second.

Intext is offering 80 pages at the moment. Hence each page will repeat after 20 seconds. If the desired page has already passed at the time of selecting, then maximum waiting time will be less than half a minute. This access time can be reduced by using more lines in the VBI. If more pages are provided the access time will increase.

The decoder

The decoder can be attached to an existing TV receiver with a little modification. The first function of the decoder is to gate out the data lines and after pulse-shaping give the data in logic levels,

The parallel data is examined with respect to the selected page and passed on if it matches the selected page. Page memory then feeds the display logic which sends data to the character generator. CG in turn feeds the dot generator and display logic

The above indicates the simple process. In practice, colour selection, boxed display, superimposed display etc may also be available in sophisticated decoders.

The ET&T (Electronics Trade & Technology Development Corporation) has imported a batch of French decoders which are being sold through some colour TV manufacturers.

Briefcase size decoder can be kept on top of the colour TV set and connected to it through a multipin socket and plug system connected by a multicore cable provided with the decoder. The decoder is remote controlled by a hand-held keyboard, just like the remote control used for some colour TV sets.

When teletext is switched on the TV screen goes blank for a few seconds till the particular page desired is captured. To keep the TV programme on even during this waiting period, there is a special button available in the keyboard. There is also provision to select the previous or the next page.

'Intext' will be received only by colour TV sets and not on black-and-white sets because of the limitation of compatibility of the decoder. ☐

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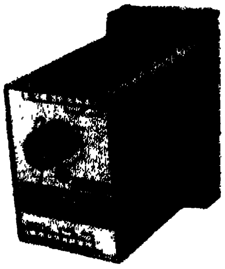

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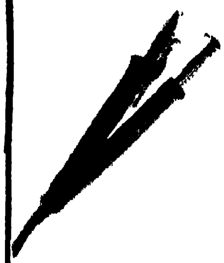

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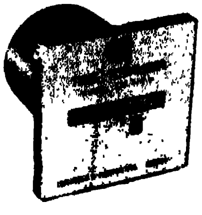

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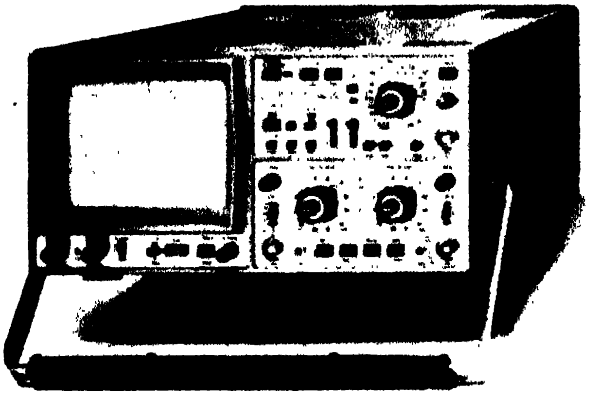

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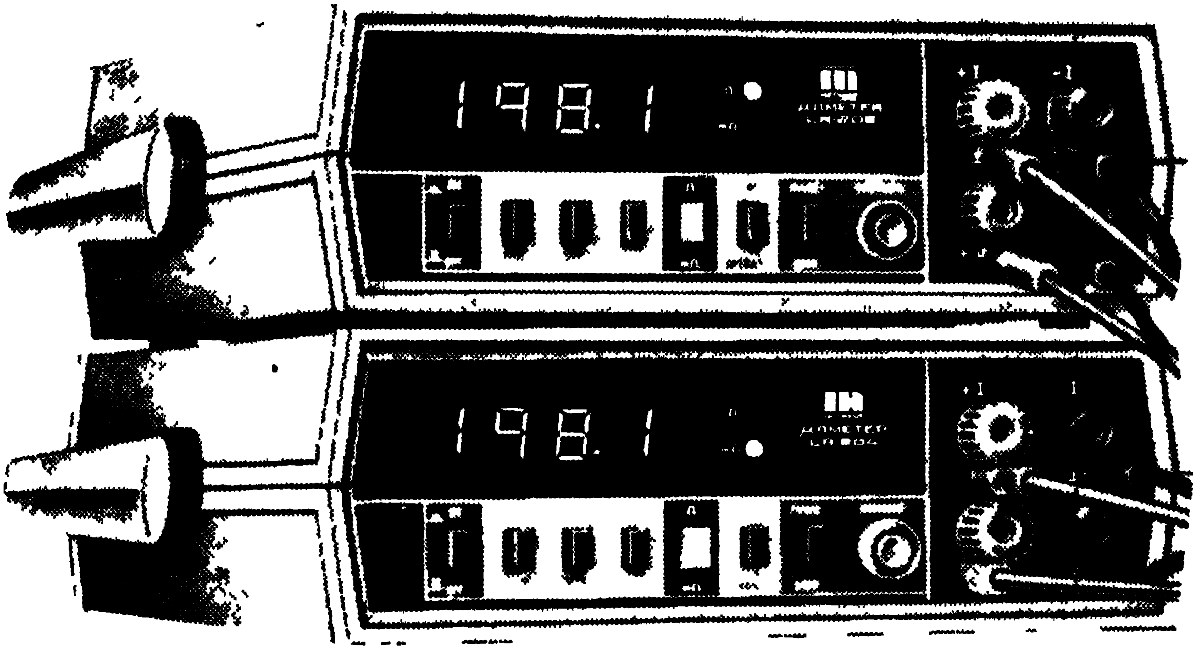

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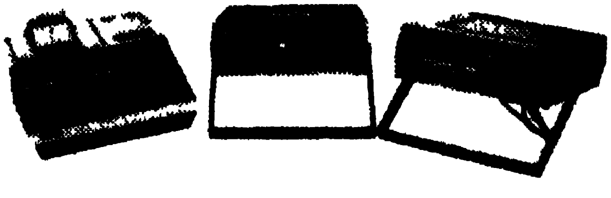

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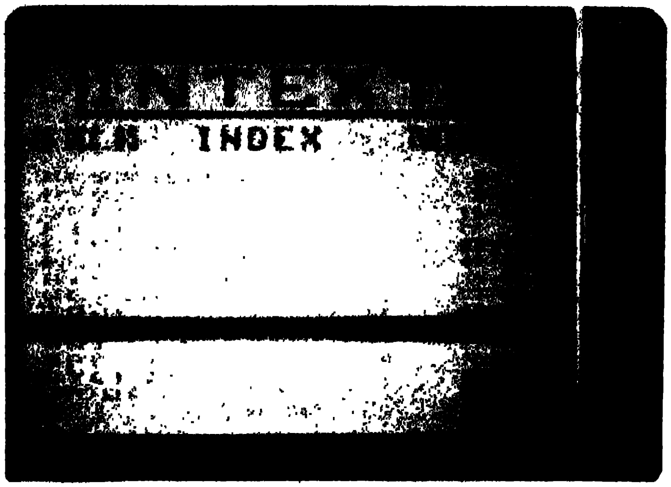
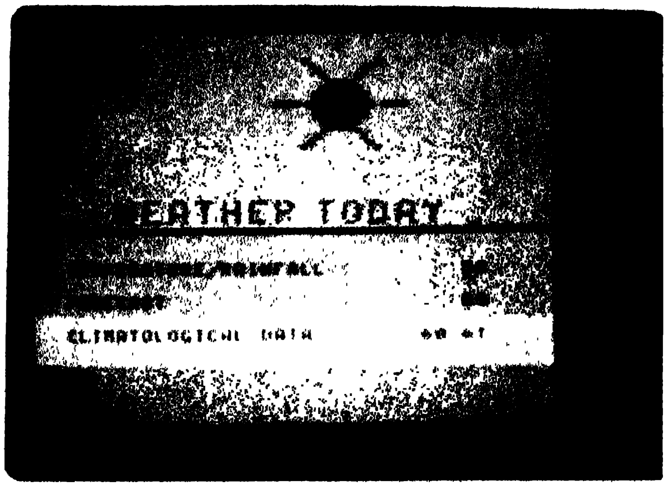
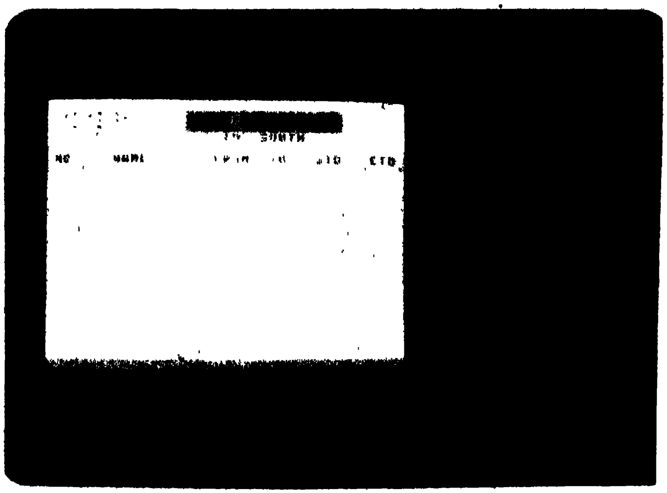
A photo-session with Intext



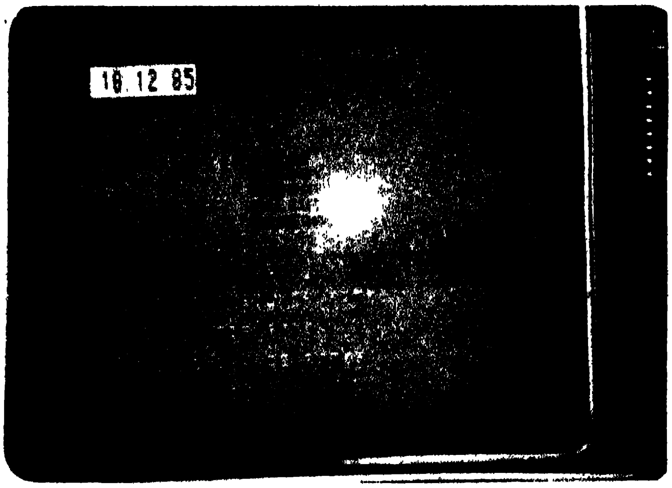
The index page of the Intext service enables the user to select the desired page.



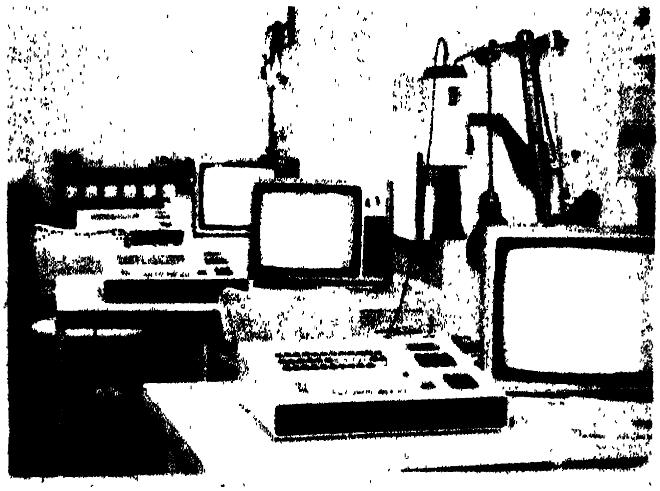
For the more weather-conscious among us—the 'weather index' page of Intext.



Going South? This departure schedule will come handy—one of the 'rail timings' pages.



For the businessman. Vital information in no time at all—the 'finance index' page.



The Intext editorial terminals at Delhi Doordarshan.

The 'editorial' room of Intext. Here the information is updated/edited before transmission.

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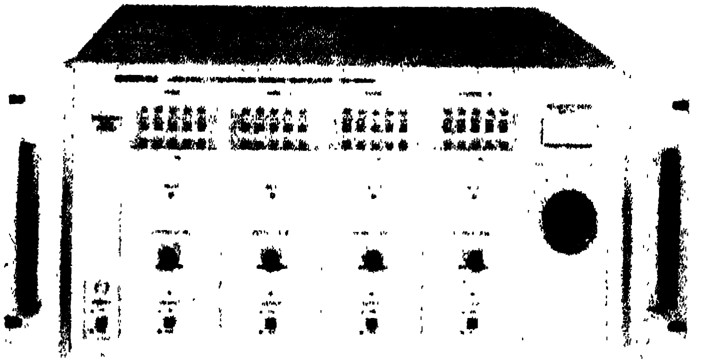

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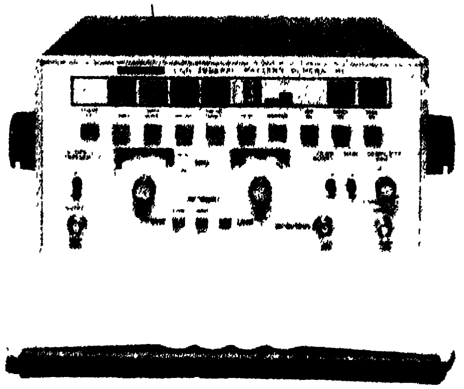

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Information from ET&T

Electronics For You has obtained some technical information on the decoder from the ET&T [Electronics Trade and Technology Development Corporation], New Delhi. EFY also interviewed Mr B.K. Bhatia, commercial and marketing engineer, ET&T for the benefit of its readers. Following are the excerpts:

Who in ET&T has made possible the import of decoders in a very short time?

ET&T chairman, Mr P.S. Deodhar, managing director, Mr B.C. Mohanty, and deputy general manager, Mr B.A. Mylar Rao—in cooperation with some other government departments.

How will the teletext information be useful?

It will be useful to every colour TV owner in general and business houses, travel agencies, hotels and financial institutions in particular. Apart from news bulletins, air and train timings etc, teletext can provide information like stock market quotations, foreign exchange rates and banking news, which is of particular interest to business houses.

But such information can be obtained from other news media also.

Information is knowledge and this will be supplied free of cost by Doordarshan. It is only a one-time investment as far as the cost of decoder is concerned, but news from other media involves recurring expenses. Also, the intext service will provide lot more information from a single source more quickly.

Do you think Doordarshan can collect the data from railways, airlines, stock exchanges etc promptly?

I can't comment on this issue.

Can anybody buy a decoder from ET&T?

We are not supplying the decoder to individuals. We are supplying only to colour TV manufacturers.

Can the decoder be directly connected to the colour TV set?

No! In existing TV sets an additional interface card with connector has to be installed for coupling the decoder with the TV.

Whom should we approach for this?

It is better to consult the dealer or manufacturer of the colour TV.

Can other people in electronics industry do the interfacing?

If you are in a hurry, you can also try this. But the decoder has to be purchased from a TV company only.

Do you think that in future the decoder facility can be built into the TV receiver?

TV industry only can explore this. This may be possible. Depending on the future trends, decoder may become a sub-assembly of the colour TV receiver. Later on video games can also be in-built.

Why is Intext accessible only to a colour TV owner?

Teletext signals are sent in colour. A special PAL decoder is needed to decode these signals. This decoder is incorporated in the colour TV sets but not in the black-and-white sets. Later this facility may be provided in black-and-white sets also.

We gather that there is some modification required in the decoder also?

Only a minor change to replace the French language PROM with the English language EPROM.

Who is doing this?

The TV industry.

Who has made the software for decoder?

NIC in consultation with Doordarshan.

Where from is the TV industry getting the EPROM copied from master EPROM?

They are getting it done from the computer industry.

Can TV manufacturers modify the software?

They cannot change the listing. At the most they can insert their name and serial number with their trademark in colour graphics.

How can the teletext be more useful and educative for children?

Much depends on Doordarshan. If they like they can transmit a sketch or a graph, fill-in-the-blanks, nursery rhymes and even organise on-the-spot painting contests.

The Intext pages

Doordarshan's Intext service is presently offering 78 pages* Following are the page numbers with contents

Contents	Page
Index	1
News Headlines	2
News Details	3-15
Sports	16-20
Finance Index	21
Share Review	22
Delhi Stocks	23
Bombay "	24
Madras "	25
Calcutta "	26
Ahmedabad "	27
Financial News	28-30
Foreign Exchange News	31-32
Bullion and Silver	33
Banking Information	34
Foreign Exchange Rates	35
Forward Trading	36-40
Rail Index (Fixed)	41
Arrivals North	42
Arrivals West	43
Arrivals South	44
Arrivals East	45
Departures North	46
" West	47
" South	48
" East	49
Air Index (Fixed)	50
Indian Airlines Arrivals	51
Vayudoot Arrivals	52
Indian Airlines Departures	53
Vayudoot Departures	54
International Arrivals	55
International Departures	56
Weather Index (Fixed)	57
Temperature Rain Fall	58
Forecast	59
National Climatological Data	60
International Climatological Data	61
Tourist Index (Fixed)	62
Vayudoot	63
Leisure Time Index (Fixed)	64
City Engagements	65
Cinema(Change weekly)	66
T V Programme	67
T V Programmes	68
AIR Programmes	69
AIR Programmes	70
Quiz	71-74
Special Informations	75-78

*Doo[illegible]shan which has a capacity of 80 pages is presently not us[illegible]he last two pages.

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4	7 Watt Stereo Amplifier	45 00	160 00
5	10 Watt Stereo Amplifier	45 00	160 00
6	20 Watt Amplifier	12 00	105 00
	with Power Supply	15 00	115 00
7	20 Watt Amplifier with Preamp	23 00	140 00
8	30 Watt Amplifier	12 00	175 00
9	Stereo Cassette Deck Module I	15 00	100 00
10	Tape Cassette Copper	45 00	250 00
11	T V PCB	95 00	650 00
12	T V Remote Control	45 00	250 00
13	T V Scope	12 00	150 00
14	Dot Bar Generator for testing Colour or B/W T V Set	07 00	150 00
15	12 Tune Melody Bell	06 50	105 00
16	Adjustable regulated power supply	10 00	75 00
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18	Light Dimmer Fan regulator	4 50	45 00

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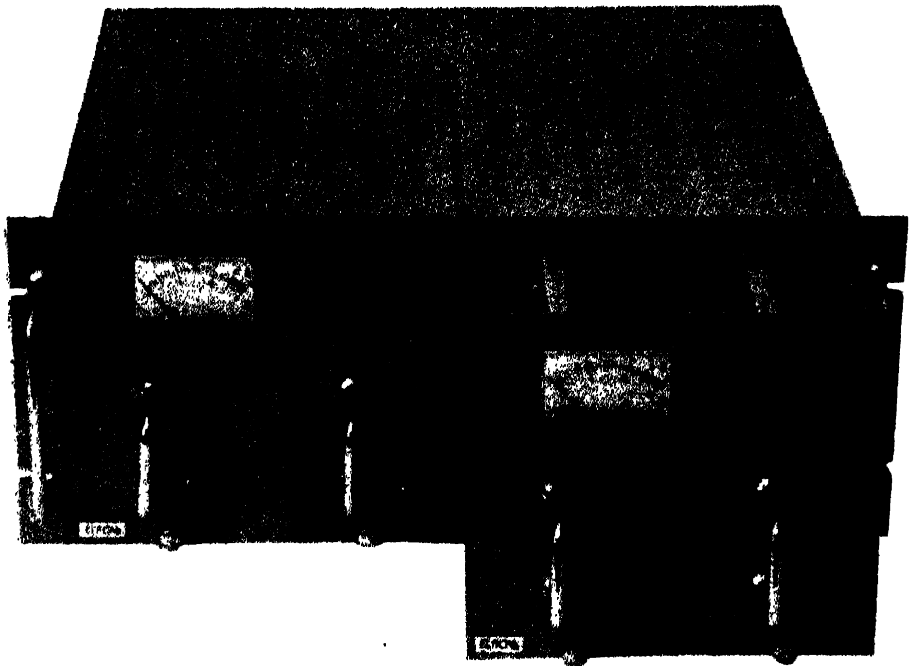

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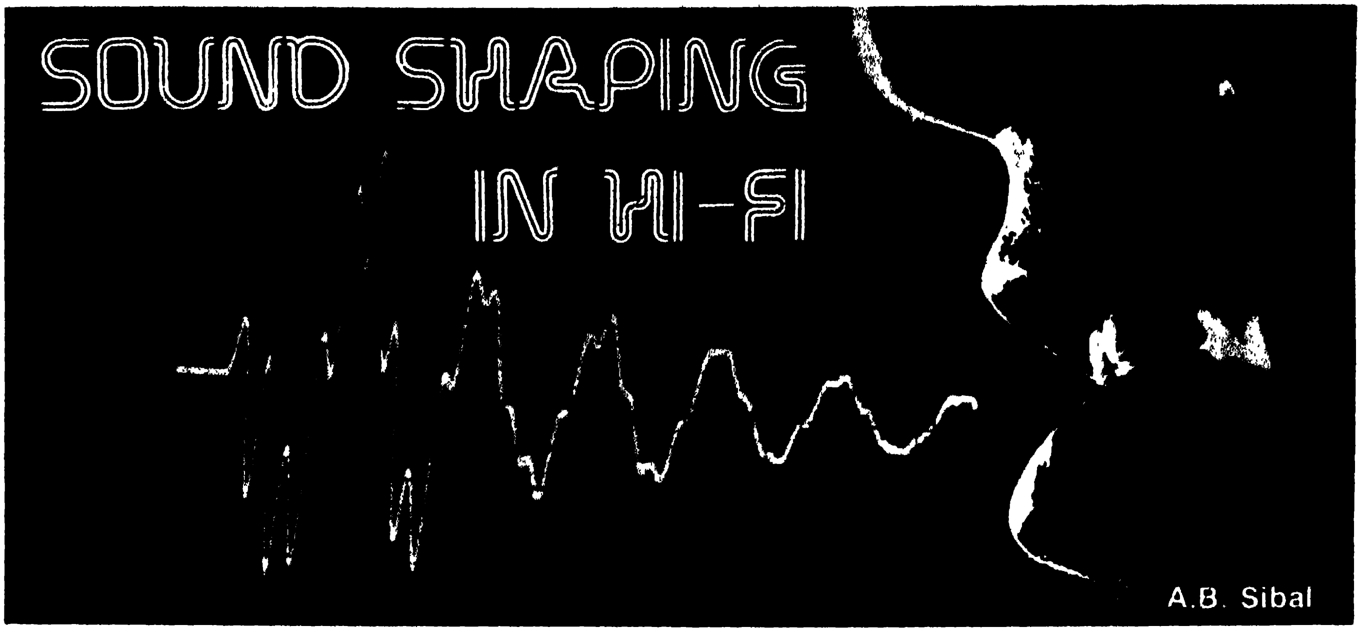


A.B. Sibal

The sound we actually hear from a hi-fi system is not entirely the result of the system's performance. We hear the result of many interacting factors which are the subject matter of applied and practical acoustics.

In hi-fi reproduction, the listening room is an important factor in estimating the system's performance. But unfortunately, little consideration is given to the listening room. Just as we control the resonance peak of the loudspeaker to get smooth reproduction, so must we tame the resonance of the room so that the system performs properly.

The reflection and absorption properties of the room affect the audio reproduction by producing many irregularities of response. A very live or resonant room is detrimental to good musical reproduction on the basis of cleanness of reproduction of notes. Live rooms affect directivity in that sound is more diffused throughout the room. On the other hand, in a dead room sound intensity decreases because the ears do not benefit from reflected sound. Such a room is wasteful of power delivered to it.

The human ear is not a linear device. The sensitivity of the ear for different frequencies changes as the sound grows softer or louder. A system optimally adjusted for the ear under one condition may be entirely out of balance for another condition. Also, the ear concentrates on a small portion of sound, viz. 400-5000 Hz, to receive good communicative intelligence. The lower and higher ends are not at all necessary for the ear to make sense out of what it hears. In high fidelity, however, we are concerned with more than this. We want the lowest throb and the highest tweet. The lows and highs belong to the musical intelligibility of sound.

But there is not much a listener can do with his living room. Designing or changing the living-room decor for this purpose may not always be possible. Nothing also can be done to modify the physiological hearing process.

So, to overcome the above shortcomings, it is much better to shape the response of the audio system so that the overall response takes the above factors into account.

Need for sound shaping

The number of controls on today's hi-fi equipment is indicative of the realisation of the need for sound shaping. Basically these controls are all means by which the listener may alter the colours of his musical picture. Purists have been debating that the listener should not have the privilege of editing or auditing of music presented to him. The listener should not corrupt the artiste's interpretation of the work, they feel. To the purist reproduction means exact duplication of the original. The purist is a lover of music.

But there is the listener who prefers to recreate the sound that is satisfying to his ears. To achieve this, he adjusts the many controls on his preamplifier, amplifier and speaker. He is a lover of sound. There is no doubt that both the 'music lover' and the 'sound lover' appreciate good reproduction. Both need sound shaping circuits and devices though for different reasons.

Tone controls

The most common and popular technique of shaping the audio response of a system is the Baxendall tone control. This circuit, in one form or the other, is used the world over. This is a control more for the lover of sound than for the lover of music. It does not allow any scope for selective adjustments of audio response except for raising or lowering signal level at bass or treble frequencies. Both bass and treble controls are generally designed to provide ± 10 dB of boost and cut (at 100 Hz for bass control and 10 kHz for treble control) relative to 1 kHz.

Let us see the working of such a circuit in the light of an operational amplifier working in the inverting mode (Fig. 1). If in such an amplifier a feedback resistor is connected from the output back to the inverting input and a series resistor is connected between the signal source and the

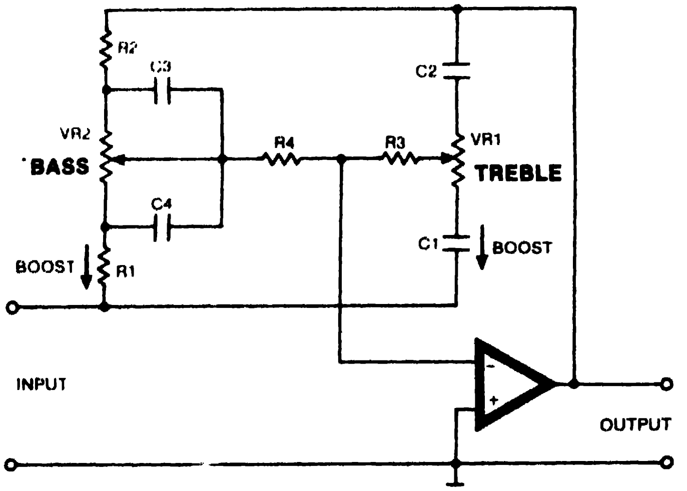


Fig. 1: The schematic diagram of the Baxendall tone control.

inverting input, the voltage gain of the amplifier is equal to the feedback resistance divided by the input series resistance. The voltage gain is therefore controlled by feedback impedance given by the tone control components and by the input series impedance.

Treble control. The treble control employs VR1, C1 and C2. The feedback resistance is through C2 and the top end section of VR1; and the input impedance is given by C1 and the bottom end section of VR1. At low and mid frequencies, C1 and C2 which are equal in value have a reactance which is high as compared to VR1 and so adjustment of VR1 has very little effect on the relative values of feedback resisttance and input series resistance which virtually remain the same. At higher frequencies reactance of C1 and C2 is comparable to VR1 and at the highest frequency this reactance is very low compared to VR1 so that adjustment of VR1 has a marked effect on sound output.

With the slider of VR1 towards C2 end, the feedback resistance becomes much lesser than input series impedance, giving significantly reduced gain or treble cut. When the slider of VR1 is moved to C1 end, the feedback resistance is much larger than the series input impedance producing increased gain or treble boost. With VR1 at the centre position, the two impedances are equal, a flat response with unity high frequency gain is obtained.

Bass control. This control also works in a similar fashion. At high and mid frequencies C3 and C4 with low reactance virtually short VR2. Since R1 and R2 have same value, the feedback impedance at these frequencies is equal to series input impedance and the adjustment of VR2 has no significant effect. At bass frequencies, compared to VR2, reactances of C3 and C4 are higher and affect the output.

In this low frequency range moving VR2 towards R2 makes the feedback resistance lower than series input resistance, resulting in reduced voltage gain or bass cut. When VR2 slider is at R1 end the voltage gain is increased, resulting boost. With VR2 at its centre position, unity gain flat bass response is obtained.

R1 and R2 limit the maximum amount of boost and cut respectively. R3 performs a similar limiting function in the treble circuit. R4 helps to minimise the interaction between the two controls.

Tone controls add to the noise and distortion problems of the system. Tone controls are acceptable only if they are essentially quiet and imperceptible in operation and can be individually switched out of the circuit when not required. They should be part of a stereo preamplifier that has the lowest noise and distortion figures. They are not effective in compensating room acoustic problems, loudspeaker errors and unsuitably balanced recordings. It is noteworthy that high quality preamplifiers are today without tone controls the world over.

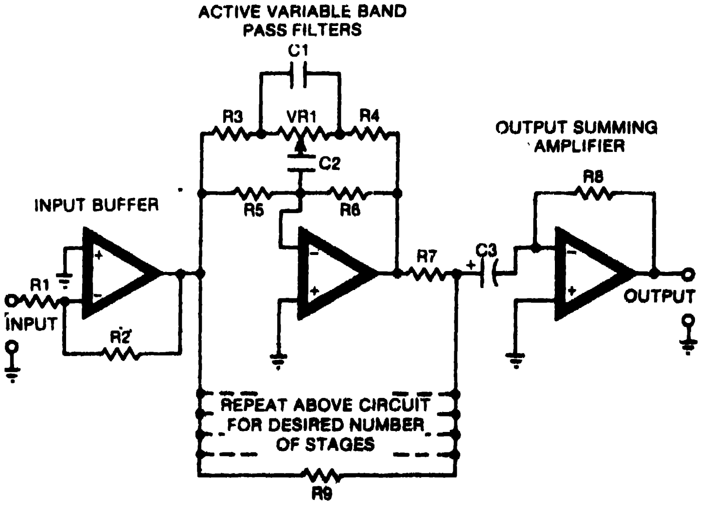
Equalisers

Equalisers are popular audio accessories these days. They are sort of supertone controls that allow the user to change small portions of audio spectrum so that overall response is neutral. They provide the ideal way of affecting any frequency modification when a specific need arises. Equalisation can be defined as a process designed to make the audio response as flat (equal) as possible at all frequencies.

Equalisers tame two types of resonance –those with gain and those with loss. And contrary to popular belief, an equaliser is called upon on more occasions to cut signals than to boost them.

Equalisers can be broken down into two sub-categories, graphic and parametric. Graphic equalisers divide the audio spectrum into a given number of bands with individual boost cut controls for each band. The centre frequency of each band is fixed. The family of response curves generated by this type of equaliser resembles a series of peaks and valleys.

In the parametric equaliser, the amount of boost or cut introduced, the central frequency of the band of equalisa-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C1
R3
VR1
R4
C2
R5
R6
OUTPUT SUMMING AMPLIFIER
R8
INPUT BUFFER
R1
INPUT
R2
R7
C3
OUTPUT
REPEAT ABOVE CIRCUIT FOR DESIRED NUMBER OF STAGES
R9

Fig. 2: The schematic diagram of the graphic equaliser.

tion and bandwidth within which equalisation is applied, are all independently variable. The parametric equaliser, providing these three variables to the listener is more versatile. It gives him the ultimate control over the sound reproduced by the hi-fi system.

Graphic equaliser. This is the most popular type of equaliser because of the fact that it is easiest to adjust. A graphic equaliser section is shown in Fig. 2. It consists of an input buffer, a desired number of active variable band pass filters and an output summing amplifier. The input buffer is a standard unity gain stage for impedance matching between the preamplifier and the equaliser section. The active filter section is actually a number of individual active filters with the same feedback design. In all the stages the values of C1 and C2 are responsible for setting the centre frequency. For VR1 normally linear pots are used. The setting of VR1 gives the degree of boost or cut desired in that stage.

The final stage is the summing amplifier buffer stage to sum the individual filters. R9 is necessary to maintain a unity gain configuration at the output with all pots set to the flat position. It subtracts the original signal from the sum by a factor dependant upon the number of filter stages. R9 is selected according to the number of bands required.

Each channel of the equaliser is controlled by separate slide potentiometers and the array on the front panel gives an approximate indication of the response inserted to modify the audio system frequency response. Human hearing is relatively insensitive to frequency response errors of less than 1/3 octave. So, if equalisation is to be taken seriously, the professional graphic equaliser will have 24 to 31 bands at 1/3 octave spacing. However, for reasons of economy, the 10-band equaliser with 1 octave spacing is the most popular for home use.

Parametric equaliser. A simplified block diagram to describe the principle of parametric equaliser is shown in Fig. 3. It shows a unity gain inverting amplifier inter-connected with state variable band-pass filter. A potentiometer is connected between the input and the output of inverting amplifier to give adjustable boost and cut. The centre frequency and filter bandwidth can be selected or adjusted by means of two potentiometers incorporated in the circuit of the band pass filter.

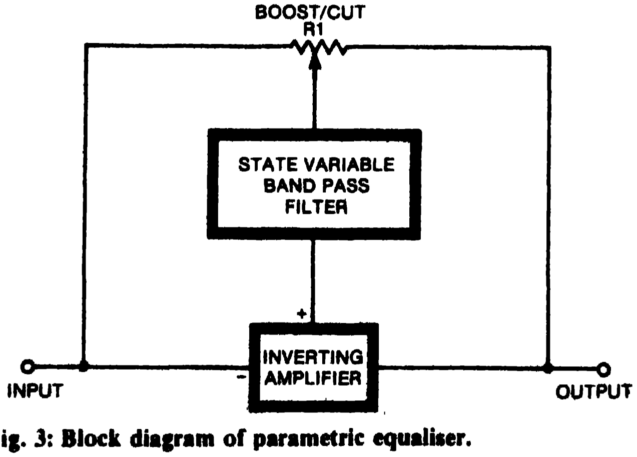

Fig. 3: Block diagram of parametric equaliser.

When the wiper of R1 is at the left extreme of its travel (input side) the output of the band-pass filter adds to the input signal, resulting in a boost within the filter pass band. When the wiper of R1 is at the right extreme of its travel (output side), the band-pass signal is subtracted from the input signal, attenuating input signal within the pass band of the filter.

At the mid point position of R1 wiper, no signal is routed to the band-pass filter as the output of the inverting amplifier is equal and out of phase with the input signal at the wiper. This means the band-pass filter will give no output and hence has no affect on inverting amplifier which therefore exhibits a flat frequency response.

A simplified schematic of one channel of such an equaliser is shown in Fig. 4. IC1 and associated resistors make the inverting amplifier. The state variable band-pass filter is composed of a differential amplifier (IC2 and its associated passive components) and two active integrators in cascade (IC3, IC4 and associated components). The bandwidth of filter can be varied by adjusting potentiometer R1 and the centre frequency selected by adjusting dual potentiometer R2. R3 is used for boost and cut.

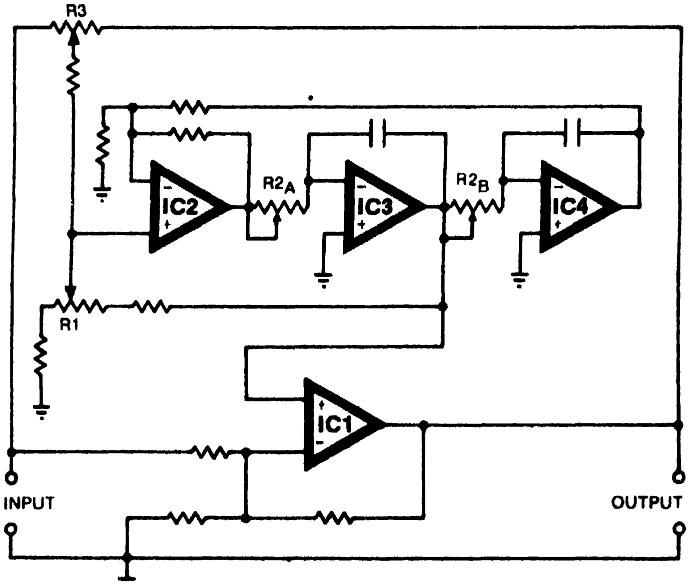

Fig. 4: Simplified schematic diagram of one channel of parametric equaliser.

Installing the equaliser

Equalisers are available as separate audio accessories with built-in power supplies. Most hi-fi systems can accommodate the equalisers through tape monitor loop. Connect the 'tape out' or 'tape record' output of your amplifier to the equaliser's input. Connect the equaliser's output to the 'tape in' or 'tape monitor' jacks of your amplifier. Push the tape monitor switch to 'on' to enable the equaliser. The signal of the preamplifier will now pass through the equaliser before entering the power amplifier.

Adjusting the equaliser

Equalisers can be adjusted in different ways. These vary in convenience, cost and accuracy. Hi-fi addicts familiar with live music can adjust the bands by the ear to match their idea of good sound (lover of sound). Another way is to use a real time analyser, a costly audio accessory, to adjust the equaliser (lover of music).

However, the room system combinations are best equalised by first employing acoustic methods followed by electronic equalisation. First try to reposition the loudspeakers, modify the absorption coefficient of the room as far as possible and adjust the speaker crossover level controls (if any)

Adjusting by the ear. Adding sharp boosts at very low and high ends of audio spectrum allows the listener to compensate for speaker roll-off. A broad dip inserted at mid-band frequency will simulate loudness control to enhance low level listening Most often a lack of deep bass or extreme high is due to limitation of the dynamic drivers.

Never try to force flat response out of the speakers by blindly applying large amounts of deep bass and extreme treble boost. Such efforts may result in an overloaded amplifier, excessive distortion and blown voice coils.

The sound due to resonance which boosts the frequency response is painfully obvious to the listener. The sound from such resonance continues in the room long after the signal has stopped. The equaliser eliminates the problem even if it is not right on the dot frequency of the resonance by reducing the energy that causes it.

Adjusting with audio analyser. The audio analyser allows the frequency response characteristic of the audio signal coming from the loudspeaker to be quickly measured and displayed. The basic unit along with its built-in microphone preamplifier and noise generator is capable of analysing signals in the octave bands.

With equaliser analyser combination one can anticipate an impressive improvement in the sound system. The characteristic of the total sound circuit (including the room) can now be easily tailored to produce an optimally flat overall response. Sound colouration due to unwanted speaker and room resonances will be substantially reduced,producing a subjectively cleaner sound.

By varying the equaliser response in the respective octave bands, the listener will get a number of plateaus on the response curve, all of which can be moved up or down independently of each other, till the display on the analyser becomes as flat as possible.

For achieving optimum equalisation the listener, for given loudspeaker position and room decor, may have to spend hours in doing the equaliser adjustments. It is better to make a cardboard template for these slider pot control settings for equalisers with slide potentiometers. Even if the controls are now altered or tampered by someone else, with the help of the template, the listener can always return quickly to the correct control settings.

In case of equalisers with rotary potentiometers a note must be made of their marking position on the dial or front panel. Such measures will save the listener many agonising hours of adjustment, especially where equalisation is done by the ear.

Conclusion

No doubt today's reproduction is more life-like and realistic but one must recognise the artiste's concern for retaining the originality of sound

But nothing in nature works by itself without being affected by something else. The listening room, loudspeaker errors and unbalanced recordings modify the sound in intensity, tonal characteristics and directivity. To get sound without coloration everything has to be 'right' acoustically and electronically. And even then the listener can only 'approach' the real performance.

The most effective way of this 'approach' is through equalisation. Tone controls at the most are only a useful facility to have but cannot effectively counter resonance problems. Equalisers built with high quality very low noise op-amp ICs (like TL071, LF351, NE5534) which are today available seem the ideal solution to this problem.

Equalisers have to be used intelligently and that too only when a specific need is apparent. Remember, equalisers are called upon to cut signals more frequently than to boost them. □

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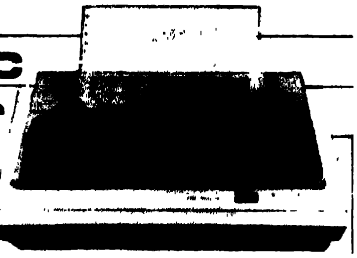
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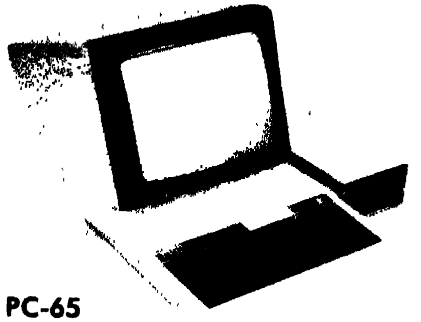

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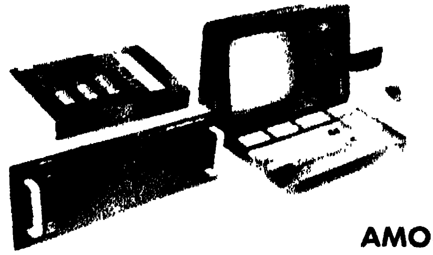

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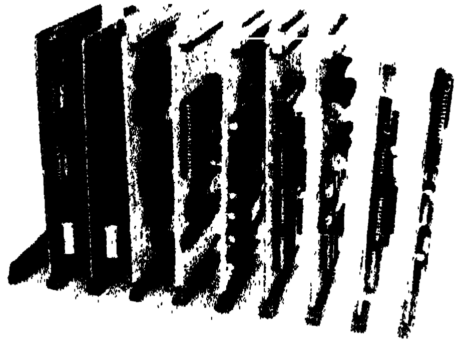

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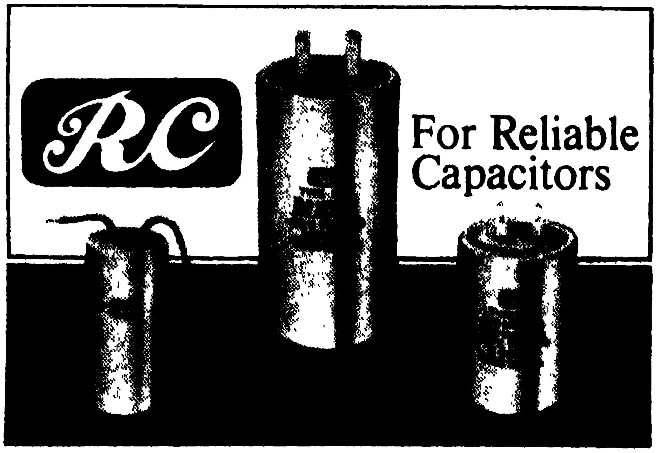

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Government departments, banking, finance and insurance offices, police forces, industry, higher-education and research establishments can use this unit, it is felt.

Low-priced CADCOM system offered

The western regional centre of the Appropriate Automation Promotion Programme at Ahmedabad has developed a personal CAD computer system.

The knowhow for the CAD system is available for the potential manufacturers through the Electronics Commission, New Delhi, according to a press release issued by the centre. It is stated that the cost of the minimum system would be less than Rs 10,000.

Some of the important hardware features of the CADCOM system are: an 8-bit Z-80 CPU processor at clock frequency of 3.33 MHz; arithmetic coprocessor AMD 9511, to enhance arithmetic processing speed; and a graphics processor 82720, to support high-speed, high-resolution graphics.

The total memory supported by the CPU is 88 Kbytes. Sixty-four KB-RAM and 24 KB-EPROM contain extended graphics BASIC interpreter and also utility packages such as debug monitor and terminal emulation. Both parallel and serial I/O interfaces are available for high speed printer, floppy drive and cassette recorder and RS-232 interface. A programmable music generator is also provided.

Touch-screen computer interface system

A touch-screen computer-interface system from Britain, fitted in front of a colour monitor display and used with appropriate software, provides an exceptionally easy, low-cost means of communicating with a computer.

Suitable for use by children and the disabled, the Touchtech 501 system comprises the touch screen and a mounting stand to which the colour monitors can be easily secured, a diskette containing nine demonstration programs and a further program that can be adapted to suit the user's needs plus a handbook. It is claimed to be the first system of its kind on the market.

The screen houses infrared sensors and projects a network of infrared beams across the surface of the screen. When the network is broken by the touch of a finger or stylus, the coordinates are fed to the host computer which is programmed to interpret the signal. The screen does not degrade the clarity of the monitor display and there is no electrical user interface, making it extremely safe.

CSI's annual convention

'Computers for productivity and quality.' This will be the theme of the 21st annual convention of the Computer Society of India [CSI]to be organised at the Netaji indoor stadium,Calcutta from January 22 to 25.

A technical exhibition will also be held during the four-day convention. Lectures, panel discussions, poster sesssions, technical sessions and manufacturers' presentations will be organised to focus on the role of computers in increasing industrial productivity in all the sectors of the economy and improving the quality of services and products.

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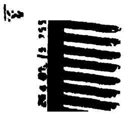

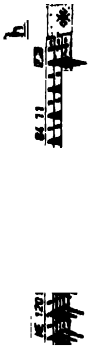

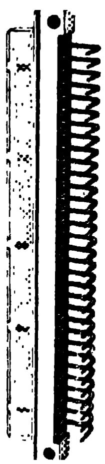

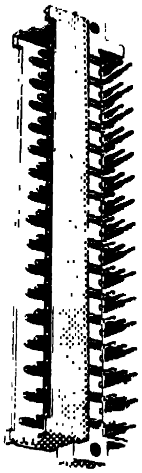

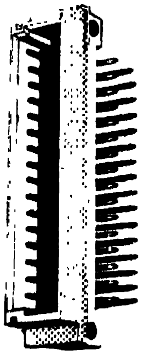

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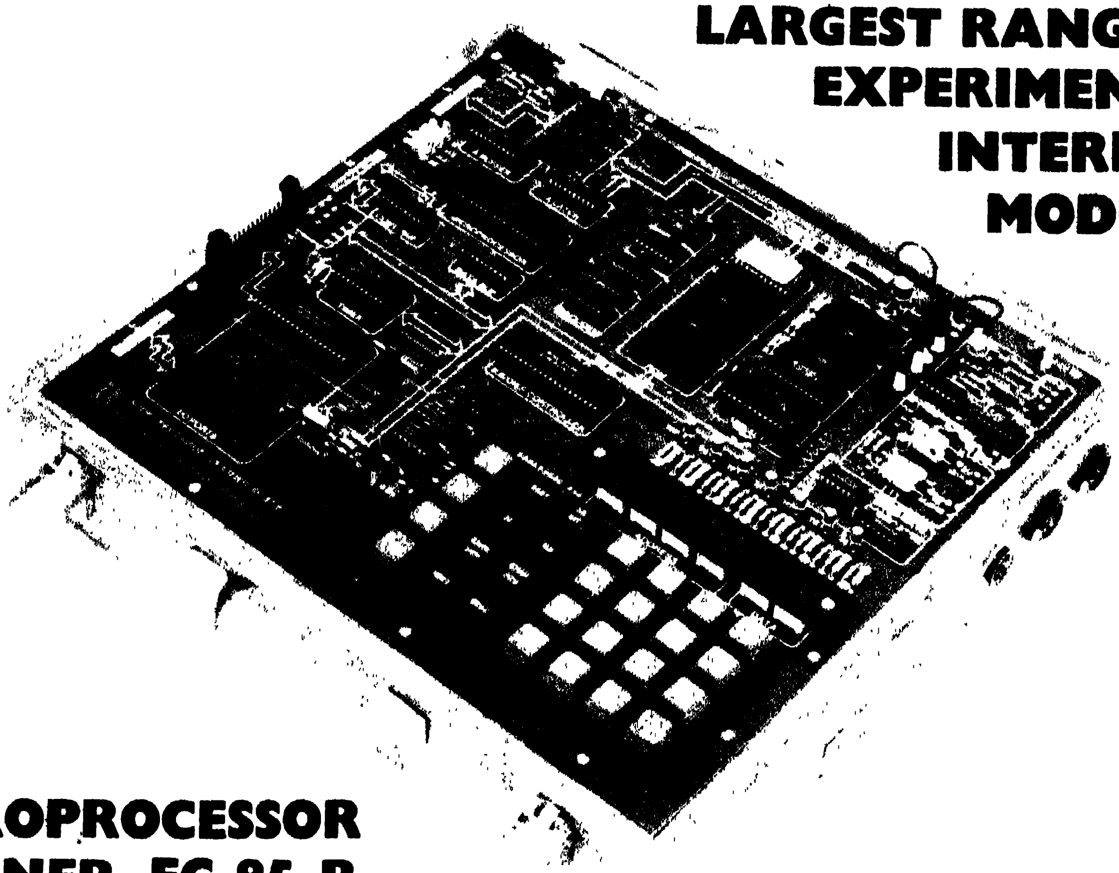

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CEW

A Simplified Guide to Computer Programming in BASIC

CHR$, ENDPROC, ABS, SPC, SIN, TAB may sound double-Dutch to you. It probably is double-Dutch. But it's the kind of double-Dutch that computers like to talk in. Unfortunately,the moron that invented computers didn't speak very good English—but he spoke damn good double-Dutch! And thats what you have to learn to do - speak another 'language'.

It's quite possible to learn computer programming in a couple of weeks or it may take a lifetime. It all depends on how 'fluent' you wish to be. Unfortunately, the story doesn't stop there. Each computer has its own different 'dialect' and you've got to learn the right one. However, there are basic similarities and this is what this article will try to explain.

OK! So you've got a computer and you've managed to decode your four million page manual to figure out how to turn the thing on. You wait there patiently for it to suddenly talk to you and answer all the questions that you've always wanted to ask, such as: What is Life? You'll be there 'till a cow jumps over the moon because contrary to common belief computers are a bit ignorant. In fact they're downright stupid! Indeed, instead of the computer telling you what to do, you have to tell the computer. You've got to list your commands precisely, and you musn't miss a single step. Otherwise the computer will just cough and then say that it doesn't know what you are blabbering on about (or rudder words to that effect!). For example, if you type in

```
10 PRINT "HELLO"    (and press RETURN or
                     ENTER key, and do this at
                     the end of each command)
20 STOP
RUN
```

the computer will write out the word HELLO on the top left hand corner of the screen. Notice that each command needs a number and by international convention it's usual to begin with 10 and then to continue with subsequent multiples of [illegible]! It's called a line number.

RUN is the command that tells the computer to start execution of your program, and it must be typed in at the end of every program.

```
10 PRINT "HELLO" (Press RETURN or ENTER key)

20 GOTO 10
30 STOP
RUN
```

GOTO means exactly what it says—GO TO line number 10.

When you typed in RUN the computer should have printed HELLO on the screen (just as before) and then, having dealt with this, your first command (line number 10), it went on to your second command (line number 20) which of course told it to go back to the first command and print HELLO again. The 64 thousand dollar question is: When does the computer get to line number [illegible] telling it to stop what it's doing)?

Got it?

No?

Well have another think.

That's right! It never gets to line num[illegible] and that's why you get HELLO printed so many times on your screen. This program is called a loop in computer double-Dutch jargon because the con[illegible] keeps going round and round in the program, never getting to the end.

If you got that question right you can congratulate yourself. You're now one step above a moron in terms of computer programming. Welcome to the rat race!

To get rid of everything on the screen type in CLS (or HOME if you've got an Apple or PRINT [illegible] if you've got a VIC or PET computer).

Ask a computer to choose an [illegible] twenty.

```
10 LET A=INT(RND*20+1) [illegible]
20 PRINT A
```

```
30 STOP                    (Press RETURN or ENTER)
RUN                          "   "   "   "   "   "
```

Note:

```
If you've got a VIC or PET change RND to RND (1) in line number 10.
"   "   "   "   BBC or Acorn Electron change RND to RND (1)
"   "   "   "   Apple then              "      "      "      "
"   "   "   "   TRS-80 "                "      "      "  RND (0)
```

The gobbledegook in brackets in the above program simply tells the computer to choose a random (RND) number between 1 and 20. Try putting in different numbers.

The INT is short for integer; otherwise the computer may quite rightly choose the number 7.86436!

LET A = ... tells the computer to put the random integer between 1 and 20 that it has chosen in a memory bank called A.

You should know enough computer programming by now to be able to figure out the rest of the program.

Got it?

Yes?

Good!

Now break out the champagne; you're two steps ahead of a moron in terms of computer programming!

Let's alter the above program so that you have to guess what the number is.

```
10 LET A=INT (RND*20+1) (Press RETURN or
                              ENTER)
20 PRINT "WHATS
     YOURE GUESS?"               "
30 INPUT B                       "
40 IF A=B THEN PRINT
   "WELL DONE"                   "
50 IF A<>B PRINT
   "WRONG-THE COR-
   RECT ANSWER WAS          "; A
60 STOP
RUN
```

Line 10 tells the computer to choose a random number between 1 and 20 and keep it in a memory bank called A.

Line 20 tells the computer to print everything within the speech marks (quotes), i.e., WHATS YOURE GUESS?

Now comes the exciting bit! You have to guess what the number A is. (Take a guess and don't forget to press the RETURN or ENTER key once you've had your guess.)

Line 30 tells the computer to wait for your guess and then put your guess in a memory space called B.

Line 40 tells the computer to see if its random number A is the same as your guess B, and if it is so it will print WELL DONE, otherwise it will do nothing and go on to line 50.

Line 50 tells the computer to see if its number A is less than or more than (i.e. not equal to) B and if this is the case then to print everything that's mentioned within speech marks. Notice the semicolon after the speech marks and then the letter A. This tells the computer not to go to line 60 until it has printed the random number that it called A in place of the letter A after the semicolon. Got it? Have another read.

You've now climbed the first three steps (perhaps the hardest of them all) that everybody has to climb before becoming proficient in computer programming. You now have the basis of programming under your belt and, believe me, it's surprising what you can do with just learning these three moron-proof steps in double-Dutch. Read on!

There is one other thing you should know. In the very first program shown to you the computer was made to loop an infinite number of times printing HELLO on the screen each time it did so. However, there is a way to control the number of times the computer loops, and it is quite useful to be able to do this while, for example, setting limits to the number of tries a player can have on a game. Take a look at this:

```
10 FOR A=1 TO 3          (Press RETURN or
                           ENTER key)
20 PRINT "HELLO"             "
30 NEXT A                    "
40 STOP                      "
RUN                          "
```

It is better to explain lines 10 and 30 together. Anything between these lines will be repeated three times so that in this example the word HELLO will be put on the screen three times. Why three? Well the number of times the computer will loop between lines 10 and 30 is dictated by the last number in line 10. For example, if line 10 was changed to

```
10 FOR A=1 TO 10
```

then the computer will print HELLO ten times.

Let's play a game in which you have to guess a random number that the computer has chosen in say three tries.

```
LIST
 10   CLS
 20   PRINT "IN THIS GAME GUESS A NUMBER
      THAT THE COMPUTER HAS IN MEMORY IN
      THREE TRIES. THE NUMBER IS BETWEEN 1
      AND 20."
 30   PRINT
 40   PRINT "PREPARE TO BE BEATEN."
 50   PRINT
 60   PRINT
 70   PRINT
 80   LET A=INT (RND*20+1)
 90   PRINT "I HAVE CHOSEN A NUMBER. GUESS
      IT IN THREE TRIES."
100   FOR C=1 TO 3
110   INPUT F
120   IF F < A PRINT "TOO LOW"
130   IF F > A PRINT "TOO HIGH"
140   IF F=A GOTO 210
150   NEXT C
160   PRINT
170   PRINT "BAD LUCK"
180   PRINT
```

```
190   PRINT "THE CORRECT ANSWER WAS  ";A
200   GOTO 220
210   PRINT  "THE  CORRECT  ANSWER-WELL
      DONE"
220   STOP
```

***Note:**
If you've got an Apple then change CLS to HOME in line number 10
" " " " VIC PET "   "   PRINT CHR$(147)

Try to first go through the program assuming that you didn't get the answer and then follow the commands in the program assuming that you did get the correct answer.

If you can do this you have uncovered the fundamentals of computer programming. This is the basis on which all programming is based and you should know enough to be able to write similar programs.

By now you are probably wondering how a computer produces games such as space invaders and moving ships on the screen. Computer animation, as it's called, is very difficult and varies enormously from computer to computer. So it's really not possible to talk about it in a general sense when so many of the readers are likely to have different computers.

Further, computer animation is rarely done in the language called BASIC (the one used in this article) because it's a very slow language and would result in very slow moving targets and missiles. It's usually written in something called machine code which I advise you to keep well away from until you've at least mastered BASIC!

But just to show you that animation isn't always that difficult here's a program which shows a moving 'ship'. Its very simple and works on the basis of putting a symbol (which represents the ship) in a position, say X, and then placing a blank space in this position X. Finally, the symbol is placed a little way further to the right (say X+1). Repeating this many times, very quickly, will give the illusion of a moving ship.

Use this program which illustrates the point if you have a Sinclair Spectrum:

```
 10 CLS
 20 LET X=0
 30 FOR A=1 TO 30
 40 PRINT AT 10, X; ">=-"
 50 GOSUB 100              (line 50 makes the
                            computer jump to line
                            100)
 60 PRINT AT 10,X; "    "
 70 LET X=X+1
 80 NEXT A
 90 STOP
100 FOR B=1 TO 15          (line 100-110 is a
                            delay sequence, i.e.,
                            dictates the speed of
                            the ship) .
110 NEXT B
120 RETURN                 (line 120 makes the
                            computer return to
                            line 50)
```

If you have a VIC, PET, BBC, Acorn Electron, Apple or TRS-80, use this program:

```
 10 CLS*
 20 LET X=0
 30 FOR A=1 TO 35
 40 PRINT TAB (X,10)">=-"
 50 GOSUB 100
 60 PRINT TAB (X,10)"    "
 70 LET X=X+1
 80 NEXT A
 90 STOP
100 FOR B=1 TO 300
110 NEXT B
120 RETURN
```

*If you are using an Apple, change CLS to HOME and if you are using a VIC or PET computer, change CLS to PRINT CHR$(147).

Space invaders is fascinating in terms of programming but it's so complex and way beyond the scope of this article. It is perhaps interesting to just note that to your computer your average space invader is just a bunch of complex mathematical equations.

But that's another story .... ☐

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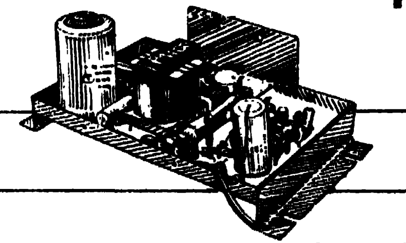

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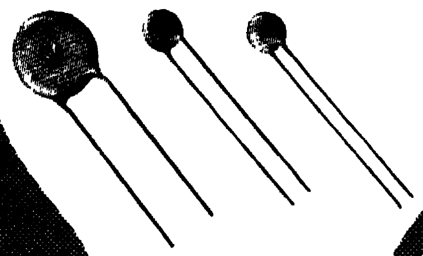

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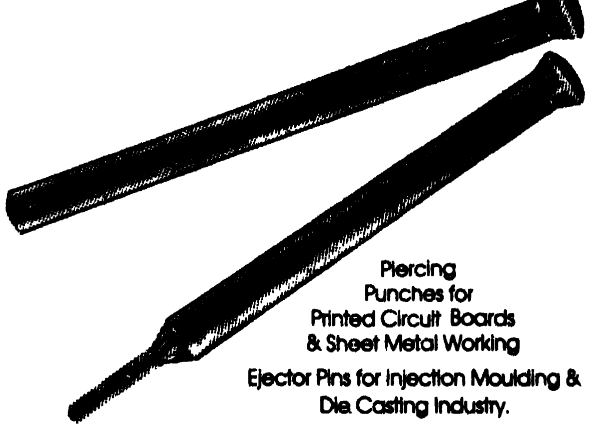

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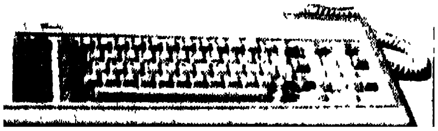

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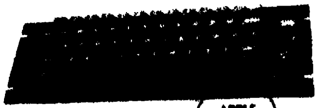

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Construction

An 8088 Microprocessor Board

K. Padmanabhan and S. Ananthi

Intel Corporation, California, produced its first 16-bit microprocessor, the 8086, in 1979. Following its success in the 8-bit microprocessor market, this product was evolved with a 16-bit architecture, a 16-bit bus and a capability of addressing up to one megabyte of memory. The instruction set had close parallels with the 8085 instruction set, but had, in addition, a large number of quite powerful instructions and addressing modes. The 8086 became popular in the first range of 16-bit microprocessor products.

About three years later, Intel made an 8-bit version of the same 8086 microprocessor, named 8088. This chip had all the power of the 8086, including its 16-bit manipulations of arithmetic and logic, but the external data bus was made to have just 8-bits, for convenience. Thus, the 8088 became more popular in the home-computer market abroad, since it simplified the hardware without sacrificing the 16-bit power. Like the 6809, it deals with certain 16-bit operations byte by byte, externally from memory.

Though the circuitry of the 8088 microprocessor hardware as well as its instructions and software are fairly complex, we have tried to give it to an average reader in a simplified fashion along with details of making an 8088 board.

As with the previous microprocessor boards published in EFY, the 8088 board also is usable with the hexadecimal keyboard and input/output board. The only board to be made now is the 8088 board and this has to be inserted in the same edge-connector sockets as the 8085/Z-80 main board, replacing the latter. With this set up, one can write software in machine code for 8088 and practice on the 8086/88 instruction set.

The 8088 processor chip

The pin diagram of the 8088 is shown in Fig. 1. Since the processor can access up to one megabyte of memory which is 16 times that of the 8085 or other 8-bit chips it needs four more address lines than the 8085. Hence its address lines go up to A19. Similar to the 8085, the 8-bit data bus is named AD0 to AD7, meaning thereby that these lines contain the address lines of low order, i.e. A0 to A7, in a multiplexed manner. The clock for the 8088 is generated externally, unlike the 8085. Hence, there is need for using a separate IC for this purpose, viz. the 8284 clock-generator chip.

The 8088 needs just a single 5V power supply. There is a READY input pin, a HOLD request pin, a HOLD-acknowledge pin, all like the 8085. There is a RESET input pin as usual. For accessing input/output ports and memory, the IO/M signal indicates that when that pin 28 goes high, it is doing an input-output operation and when that pin goes low, it is doing a memory read/write operation. Read and write control signals come out of pins 29 and 32. There is, in addition, a pin 27 which is called DT/$\overline{R}$ (data transmit/receive) which is useful for connecting the data bus through a buffer. A bidirectional buffer is required in this case since data can either go in or out of the 8088 and so, in order to enable the direction to be controlled, this signal becomes necessary. With the 8085, there was no need for such a buffer, since, for one reason, we did not intend attaching a large memory board to it so that it needed buffering, and for another, the 8085 has sufficient internal buffering. But the 8088, being a more powerful 16-bit processor, naturally would be used with more memory and peripherals and hence would need its data bus to be buffered.

There are two possible interrupts, one the NMI (or non-maskable interrupt pin 17) and the other the usual INTR pin 18 like that for the 8080/85. The NMI and INTR input pins enable a large number of interrupt handling features, more than in the 8085. The INTR pin when taken high, interrupts the 8088 and an interrupt-acknowledge signal comes via pin 24 ($\overline{INTA}$).

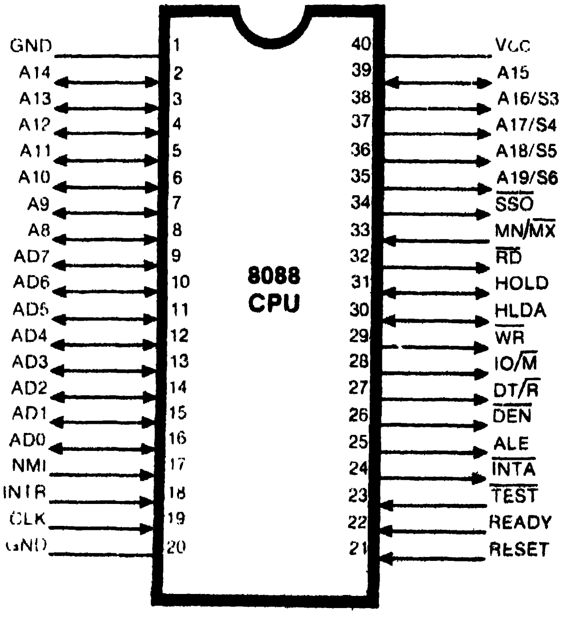


Fig. 1: Pin details of 8088.

There is another special pin called TEST (23) and also a 'Wait for Test pin low' instruction which puts the processor in an idle state, until this pin is pulled low momentarily. This is a useful software aid, similar, but not as useful as the 6809's SYNC instruction.

The RESET and READY input signals are derived from the 8284 clock-chip and not directly, the reason being that these inputs should be synchronised with the clock signal.

Apart from all these, there is another pin called the MN/$\overline{\text{MX}}$, (minimum/maximum mode) control pin. When this pin is tied to 5V, the 8088 works in its so-called 'minimum system' hardware configuration. This means that there is another 'maximum system' configuration possible for the 8088 to work with. In the latter system, the 8088 works as one member of a bigger family of multiple microprocessor chips. The 8088 has built-in logic to handle bus-access priorities in such multi-chip systems. In such systems, each processor will have its own memory and each processor can also share a common memory. Intel itself has produced the possible other members of such a family, such as the 8087 numeric coprocessor, the 8089 peripheral handling processor etc.

In that maximum mode, some of the pins discussed earlier perform a dual function with the help of another chip, an 8288 system controller. In this article, we do not inten discussing the maximum mode.

The clock signal for the basic 8088 chip is a 5MHz derived via a divide-by-three circuit used in the 8284 clock chip, from a standard 15MHz crystal connected to it. Ther is an 8MHz version of the 8088 chip also, which runs 60 pe cent faster than a normal 8088. The simplest instruction o the 8088 takes about three clock-ticks and hence the virtua instruction speed of the processor is 1.6 MHz. This is nearl

PARTS LIST

8088 CPU	1 no
74LS374 / 74LS373	1 no
74LS245	1 no.
2732	1 no
6116	1 no
8284	1 no.
74LS155	1 no
7400	1 no
74LS04	1 no. (This is not necessary if 74LS373 were used.)
1k, ¼W	5 nos
2.2k, ¼W	1 no.
680 ohms	2 nos
15MHz crystal	1 no
0.1 µF	1 no.

IC bases: 40 pin - 1 no., 24 pin-2 nos., 20 pin - 2 nos., 16 pin - 1 no., 14 pin 2 nos., 18 pin - 1 no

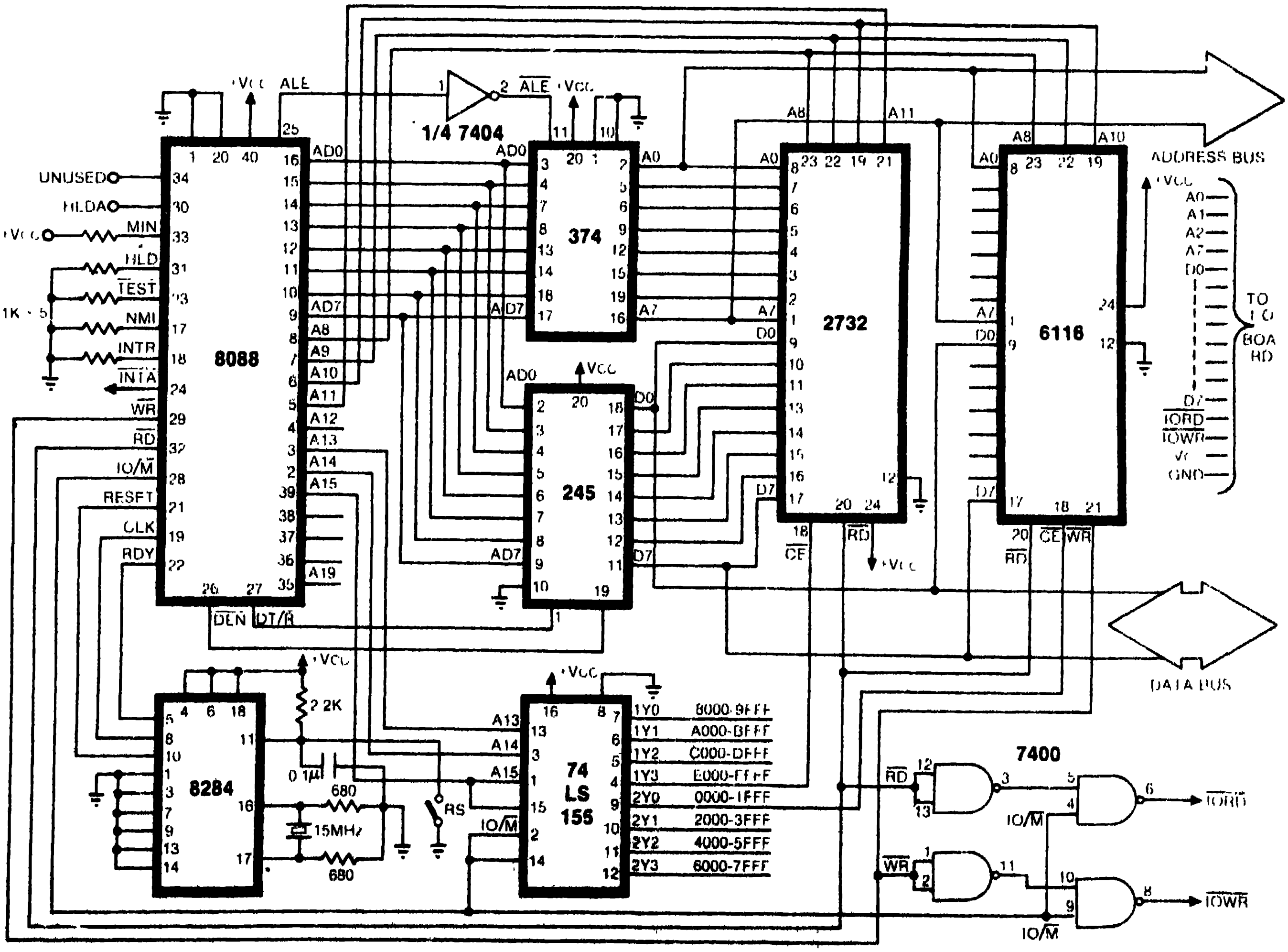
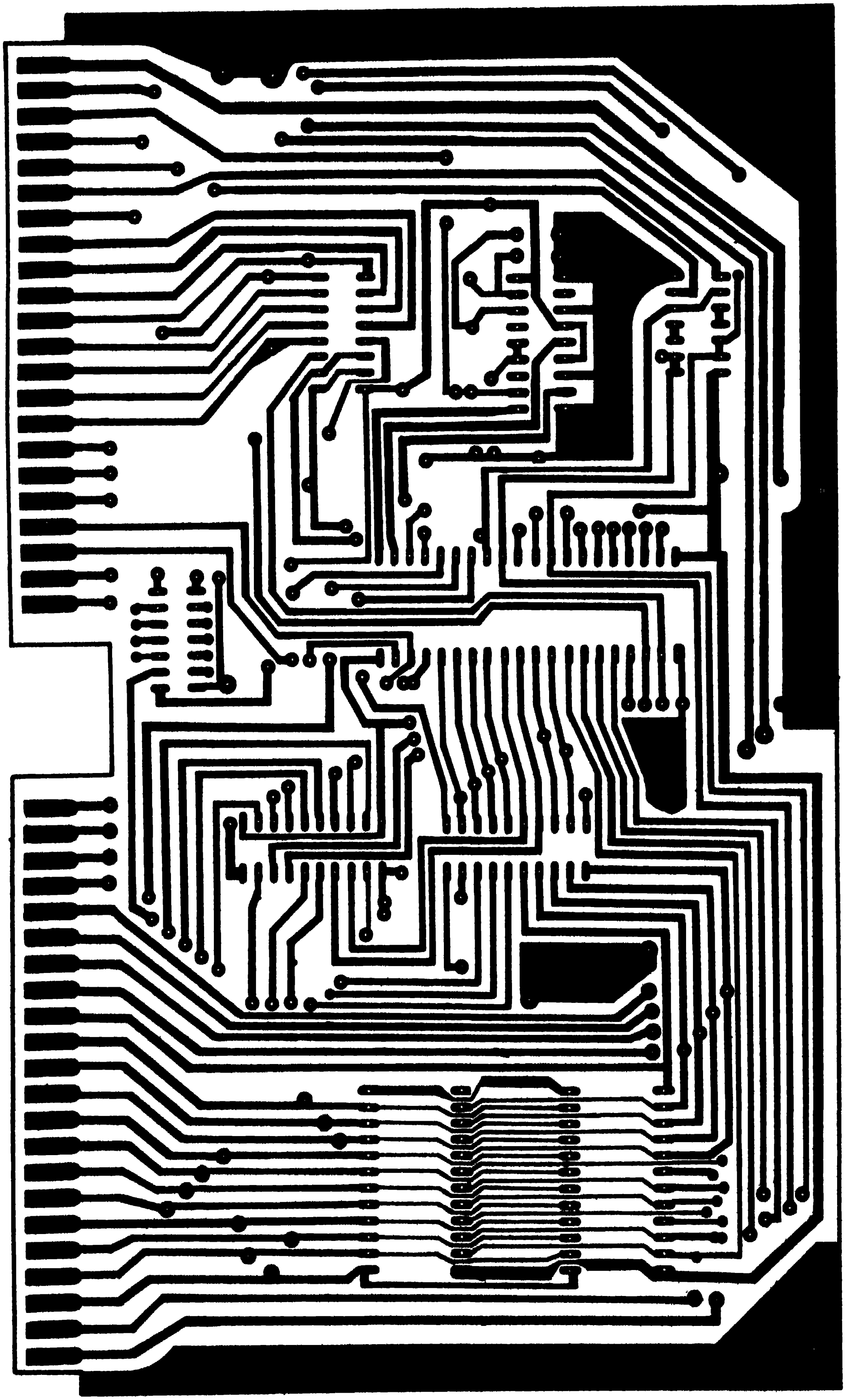


Fig. 2: Circuit diagram of 8088 add-on board



ig. 3: Actual size PCB of 8088 main board

three times faster than the speed of the normal 8085.

The circuit diagram of the 8088 board is shown in Fig. 2. The 8284 clock generator uses a 15MHz crystal, divides it by three and generates the clock for the 8088. It also generates the RESET and READY signals, synchronised with the clock. A RESET switch is therefore connected to the 8284.

The HOLD, $\overline{TEST}$, NMI, INTR pins are tied through resistors to ground, since there is no need to use them now. However, the NMI and INTR pins are also brought to the edge connector, to the same points as the TRAP and 7.5 pins of the 8085 board.

The AD0-AD7 multiplexed address-data lines are fed to the 74LS374 whose output provides the A0-A7 low-order address lines, after demultiplexing them with the address-latch-enable (ALE) pulse going to pin 11. The AD0-AD7 lines also go to the 74LS245 buffer. The $\overline{DEN}$ (pin 26) and DT/$\overline{R}$ (pin 27) are connected to the enable and direction-control pins of this bidirectional bus-buffer chip. Hence, the pins 11 to 18 of this chip provide the buffered data bus for use by the system.

The address decoder 74LS155 chip is given the high order address lines A13, A14 and A15 as well as the memory-enable signal. The address lines A13 to A15 can vary from all zeros to all ones, like 000 to 111. These eight combinations are available from the output pins of the 74LS155 decoder. The corresponding hexadecimal address ranges are as shown in Fig. 2. Among these, the 8k block from E0 00 to FF FF address is used for the EPROM selection and the 8k block lying in the lowest memory range, the 00 00 to 1F FF is used for connection to the chip-enable of the RAM chip. The remaining six numbers of the 8k memory blocks are usable in any external memory board. These lines are all brought out via the same (similar) edge connector pins as of the 8085 board and so the boards are interchangeable.

Address lines A0 to A7, as well as A8, A9, A10 and A11 go to the address pins of the 2732 EPROM. The $\overline{RD}$ signal from 8088 also goes to the output enable pin 20 of the 2732 EPROM.

Address lines A0 to A7, A8, A9 and A10 go to the address-input pins of the RAM chip 6116. $\overline{RD}$ and $\overline{WR}$ signals of the 8088 go to its pins 20 and 21, its output enable and write-enable pins.

The EPROM address is in high end of the memory range since the 8088, upon RESET, causes the program to begin, fetching instructions from the address FF F0. Hence this address must be in non-volatile memory or PROM, so that program execution of the monitor takes place as soon as power is applied and RS (reset) switch pressed.

The RAM is kept in the lowest part of the memory since the interrupt vectors are designed by the 8088 to access this space.

The PCB pattern and construction

The PCB employed is single side, glass epoxy, and the layout configuration is shown to full size in Fig. 3. Note that the two IC chips 2732 and 6116 have like pins for address and data and hence these are connected via lines going in between the IC pins. The component side layout is given in Fig. 4. The jumpers shown are to be made. IC sockets are soldered in places marked for the ICs.

After wiring the board and inserting the chips, the same is inserted in the edge connector sockets. The 5V supply is switched on and then the board is ready to function. The 2732 is to be preprogrammed with the monitor given later.

The 8088 architecture

As mentioned earlier, the 8088 is an 8-bit version of the 8086, but internally it has a 16-bit data path. However, in order to have upward compatibility with the 8085, both bytes operation (8 bits) and word operation (16 bits), are possible. Thus one could write a program to add bytes or words.

Another feature of the 8088 is that while instructions are fetched from program memory, these are temporarily kept stored inside its so-called bus interface unit (BIU). Up to four bytes in a queue can be held in it, while the execution of the fetched instructions is taking place. Thus, unlike the 8085, it can fetch an instruction even before a fetched instruction is executed. This is called a 'pipeline' architecture and speeds up the program. The 8088 will begin its fetching instruction codes as soon as one or more bytes in the queue gets empty.

As mentioned earlier, the maximum memory address range of the 8088 is one megabyte. Address lines greater than A15, up to A19, are for this purpose. However, at one stretch, one can access only a 64k within this one megabyte space. But one should not think that this one megabyte is partitioned into 16 blocks of 64k each. The partitions can be anywhere and may even overlap.

These partitions are called 'segments'. The beginning address of a segment in this one megabyte space can be chosen by 16 bits (or 4 hex. numbers). For example, let us choose the beginning of the segment at 12340. Then the extant of this segment is from

Beginning address	1 23 40	(Hex)
to	+ FF FF	
End address	2 23 3F	

A segment beginning address must have a 0 at its last digit. In the above, it was 12340. Thus, a segment and the next can overlap up to as small as 16 bytes. Out of the 20-bit memory address, the last four bits are always zero for the beginning address of a segment.

There are four segment registers in the 8088 to contain this information about the beginning address. They are called:

CS	Code segment	This segment is for the program codes
DS	Data segment	This segment is the area of memory where data resides
SS	Stack segment	This segment is used as stack
ES	'Extra' segment	This is an 'Extra' segment, used for data, in those cases where data has to move from one block to another.

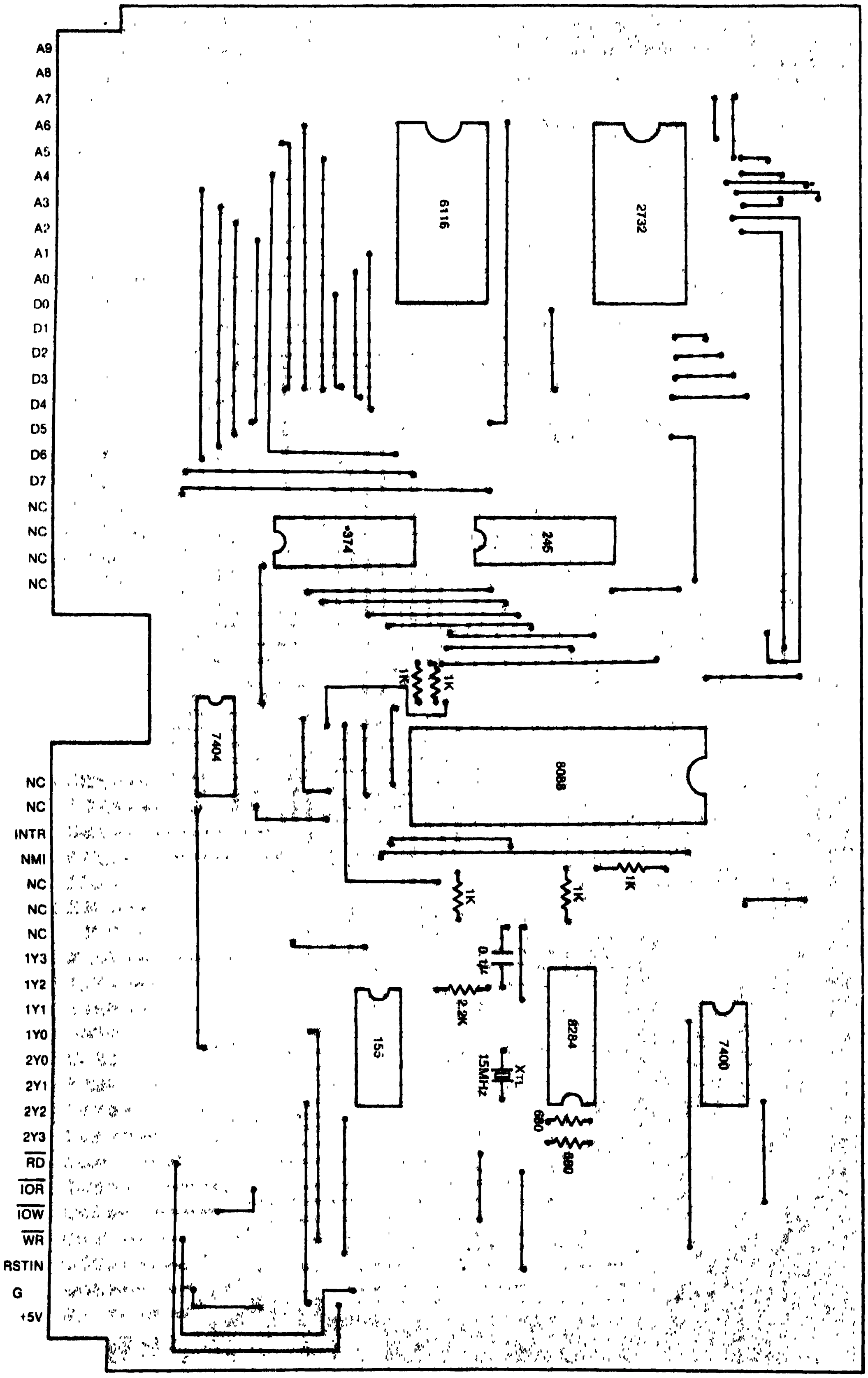


Fig. 4: Component layout of PCB

Having defined the beginning points of these segments, one can write programs which access within the segment, as one would usually do. In case one has to go beyond the segment space, the segment register has to be redefined. Thus, if a program which resides in one segment of 64k wants to jump to another program in another area which is outside this 64k space, then the code-segment register will have to be altered to get at it.

Apart from these above mentioned 4-segment registers, the remaining registers (Fig. 5) are almost familiar. The 8085 had the following registers.

	Accumulator
H	L
B	C
D	E

each of which was eight bits wide. Sometimes, even in the 8085, certain instructions which could use the register-pair were useful, such as the double-add instruction to add H-L to B-C or H-L to D-E pair. In 8086/88, Intel has followed the same philosophy for the sake of compatibility and has made the registers of the 8086/88 useful either as a word-register (16-bit) or as two byte (8-bit) registers.

Accumulator high + Accumulator low = AX Reg
BH + BL = BX Reg
CH + CL = CX Reg
DH + DL = DX Reg

For word operations, one uses the above AX,BX,CX,DX word registers, but for work involving bytes, they can be split as AH,AL, or BH,BL etc. These 8-bit registers resemble those of the 8085 shown above, except that in the 8085 there was no AH register.

Apart from the above registers compatible with 8085, Intel found that it should provide index registers like the Z-80, 6800 etc.

Memory Reference	Segment Register	Base Register	Index Register	Possible Displacements			Assembly Language Operand Mnemonic
				16-Bit Unsigned	8-Bit High-order Bit Extended	None	
Normal Data Memory Reference	DS (Alternate* (CS,SS or ES)	None	SI	*	*	*	SEE INSTRUCTION SET
			DI	*	*	*	
		BX	SI	*	*	*	
			DI	*	*	*	
			None	*	*	*	
	DS	None	None	*			
	SS (Alternate* CS, DS or ES)	BP	SI	*	*	*	
			DI	*	*	*	
			None	*	*		
Stack	SS	SP	None				
String Data	DS	None	SI				
	ES	None	DI				
Instruction Fetch	CS	PC	None				
Branch	CS	PC	None		*		
1/O Data	DS	DX	None				

* The segment override allows DS or SS to replaced by one or the other segment registers

These are displacements that can be used to compute memory address.

Fig. 5: Table showing addressing possibilities using code segment, Base pointer and Index Registers

The 16-bit word-size registers used for indexing, useful for memory reference are: source index register (SI), destination index register (DI), and base pointer register (BP).

The stack pointer (SP) and the program counter (PC) are exactly as in the 8085, being 16-bit registers.

Because these are only 16-bit in length, memory reference is not restricted to 64k block, since the effective actual address of a memory point will be obtained by the sum of the segment register and the program counter (or stack pointer, as the case may be). For example, the CS segment-register can be 1234.

If the program counter has the value at one time, say, A0 B0 then, the actual memory pointed to is at

1 23 40	(You add the 0 at the end of CS value)
A0 B0	Add the PC value, right justified
1 C3 F0	This is the address of the memory

Thus the segment registers enable access anywhere within the one megabyte memory space. Compatibility with 8085 is achieved in having a 16-bit pointer to stack and for PC, in order that all previous programs of 8085 can be easily converted and reloaded in one segment of the 8088's total memory.

The flag register of the 8088 has the following two bytes.

X	X	X	X	TF	DF	IF	OF	S	Z	X	AC	X	PE	X	C
				11	10	9	8	7	6		4		2		0

Note that some bit positions are unused in the flag. Also, the first 0 to 7 bits resemble the corresponding flag bits of the 8085. The bits 8 to 11 are flags indicating overflow, interrupt enable, direction (string transfer), and TRAP (trace mode).

The instruction set of the 8088

There are around 75 instruction mnemonics in the 8086/88 set. They can be grouped generally as:

(a) Data movement instructions
(b) Arithmetic instructions
(c) Logical instructions
(d) Shift and rotate instructions
(e) String manipulating instructions
(f) CALL, RETURN and JUMP instructions

Data movement instructions have both byte and word options. Data can be moved between any register and memory, and vice versa. The mnemonic MOV is used similar to the 8085. XCHG instruction is useful for exchange of data between registers. XLAT instruction is an extra which allows table loop-up. (See Fig. 6.) Addressing modes are mostly register-indirect, with or without displacement, which can be a byte or a word. The 'Load Effective Address' (LEA) instruction gets only the address (16-bit) instead of the operand, as in the 6809.

Among arithmetic instructions, it is possible to add binary numbers, 8- or 16-bit between a memory location and any register. Likewise, binary subtraction is also possible.

DATA TRANSFER

MOV Move:	76543210	76543210	76543210	76543210
Register memory to fror	100010dw	mod reg r		
Immediate to register mi	1100011		dat	
Immediate to register	1011 w reg		data if w 1	
Memory to accumulator	010000w		addr high	
Accumulator to memory	1010001		addr high	
Register memory to segn	10001110	mod 0 reg r m		
Segment register to regist	10001100	mod 0 reg r m		

PUSH Push:				
Register memory				
Register	01010 reg			
Segment register	000 reg 110			

POP Pop:				
Register, memory	10001111	m		
Register	01011 reg			
Segment register	000 reg 111			

XCHG-Exchange:				
Register memory with register	1000011w	mod reg r m		
Register with accumulator	10010 reg			

IN-Input from:				
Fixed port	1110010w	port		
Variable port	1110110w			

OUT Output to.				
Fixed port	1110011	port		
Variable port	1110111w			
XLAT-Translate byte to AL				
LEA Load EA to register	10001101	mod reg r m		
LDS-Load pointer to DS	11000101	mod reg r m		
LES-Load pointer to ES	11000100	mod reg r m		
LAHF-Load AH with flags	1001111			
SAHF Store AH into flags	10011110			
PUSHF-Push flags	10011100			
POPF-Pop flags	10011101			

ARITHMETIC

ADD-Add:				
Reg memory with register to either	000000dw	mod reg r m		
Immediate to register memory	100000sw	mod 000 r m	data	01
Immediate to accumulator	0000010w	data	data if w 1	

ADC-Add with carry:				
Reg, memory with register to either	000100dw	mod reg r m		
Immediate to register memory	100000sw	mod 010 r, m	data	data if s w 01
Immediate to accumulator	0001010w	data	data if w 1	

INC=Increment:				
Register memory	1111111w	mod 000 r m		
Register	01000 reg			
AAA-ASCII adjust for add	00110111			
DAA-Decimal adjust for add				

SUB=Subtract:				
Reg. memory and register to either	001010dw	mod reg r, m		
Immediate from register memory	100000sw	mod 101 r, m	data	data if s w 01
Immediate from accumulator	0010110w	data	data if w 1	

SSB-Subtract with borrow	76543210	76543210	76543210	76543210
Reg memory and register to either	000110dw	mod reg r m		
Immediate from register memory	100000sw	mod 011 r m	data	data if s w 01
Immediate from accumulator	0001110w	data	data if w 1	

DEC Decrement:				
Register memory	1111111			
Register	01001 reg			
NEG Change sign	1111011w			

CMP-Compare:				
Register memory and register	001110dw	mod reg r m		
Immediate with register memory	100000sw	mod 111 r m		
Immediate with accumulator	0011110w	data		
AAS ASCII adjust for subtract	00111111			
DAS-Decimal adjust for subtract	00101111			
MUL-Multiply (unsigned)	1111011w	mod 100 r m		
IMUL-Integer multiply (signed)	1111011w	mod 101 r m		
AAM-ASCII adjust for multiply	11010100	00001010		
DIV-Divide (unsigned)	1111011w	mod 110 r m		
IDIV Integer divide (signed)	1111011w	mod 111 r m		
AAD-ASCII adjust for divide	11010101	00001010		
CBW-Convert byte to word	10011000			
CWD Convert word to double word	10011001			

LOGIC

NOT Invert	1111011	mod 010 r m		
SHL SAL Shift logical arithmetic left	110100v	mod 100 r m		
SHR-Shift logical right	110100v	mod 101 r m		
SAR Shift arithmetic right	110100v	mod 111 r m		
ROL Rotate left	110100 w	mod 000 r		
ROR-Rotate right	110100			
RCL-Rotate through carry flag left				
RCR-Rotate through carry right				

AND-And				
Reg memory and register to either	001000dw	mod reg r m		
Immediate to register memory	1000000w	mod 100 r		
Immediate to accumulator	0010010w	data		

TEST And function to flags no result.				
Register memory and register	1000010w	mod reg r m		
Immediate data and register memory	1111011w	mod 000 r m	data	a if w 1
Immediate data and accumulator	1010100w	data	data if	

OR-Or:				
Reg memory and register to either	000010dw	d reg r		
Immediate to register memory			data	data
Immediate to accumulator			data if w 1	

XOR=Exclusive or:				
Reg memory and register to either		mod reg r		
Immediate to register memory	1000000w			w 1
Immediate to accumulator				

STRING MANIPULATION

REP-Repeat	1111001			
MOVS=Move byte word	1010010			
CMPS=Compare byte word	1010011			
SCAS=Scan byte word	1010111			
LODS Load byte wd to AL AX	1010110			
STOS-Store byte wd from AL AX	1010101w			

Fig. 6: [illegible]e of instruction set summary

CONTROL TRANSFER

CALL Call:

	76543210	76543210	76543210
Direct within segment	11101000	disp-low	disp-high
Indirect within segment	11111111	mod 010 r/m	
Direct intersegment	10011010	offset-low	offset-high
		seg-low	seg-high
Indirect intersegment	11111111	mod 011 r/m	

JMP–Unconditional Jump:

	76543210	76543210	76543210
Direct within segment	11101001	disp-low	disp-high
Direct within segment short	11101011	disp	
Indirect within segment	11111111	mod 100 r/m	
Direct intersegment	11101010	offset-low	offset-high
		seg low	seg high
Indirect intersegment	11111111	mod 101 r/m	

RET–Return from CALL:

	76543210	76543210	76543210
Within segment	11000011		
Within seg adding immed to SP	11000010	data low	data high
Intersegment	11001011		
Intersegment adding immediate to SP	11001010	data low	data high
JE/JZ–Jump on equal/zero	01110100	disp	
JL/JNGE Jump on less/not greater or equal	01111100	disp	
JLE/JNG Jump on less or equal/not greater	01111110	disp	
JB/JNAE Jump on below/not above or equal	01110010	disp	
JBE/JNA Jump on below or equal/not above	01110110	disp	
JP/JPE–Jump on parity/parity even	01111010	disp	
JO Jump on overflow	01110000	disp	
JS Jump on sign	01111000	disp	
JNE/JNZ–Jump on not equal/not zero	01110101	disp	
JNL/JGE Jump on not less/greater or equal	01111101	disp	
JNLE/JG–Jump on not less or equal/greater	01111111	disp	

	76543210	76543210
JNB/JAE Jump on not below/above or equal	01110011	disp
JNBE/JA Jump on not below or equal/above	01110111	disp
JNP/JPO–Jump on not par/par odd	01111011	disp
JNO–Jump on not overflow	01110001	disp
JNS–Jump on not sign	01111001	disp
LOOP Loop CX times	11100010	disp
LOOPZ/LOOPE–Loop while zero/equal	11100001	disp
LOOPNZ/LOOPNE Loop while not zero/equal	11100000	disp
JCXZ–Jump on CX zero	11100011	disp

INT Interrupt

	76543210	76543210
Type specified	11001101	type
Type 3	11001100	
INTO Interrupt on overflow	11001110	
IRET Interrupt return	11001111	

PROCESSOR CONTROL

	76543210	76543210
CLC Clear carry	11111000	
CMC–complement carry	11110101	
STC Set carry	11111001	
CLD Clear direction	11111100	
STD Set direction	11111101	
CLI–Clear interrupt	11111010	
STI–Set interrupt	11111011	
HLT–Halt	11110100	
WAIT Wait	10011011	
ESC–Escape (to external device)	11011xxx	mod xxx r/m
LOCK–Bus lock prefix	11110000	

Footnotes:

AL 8-bit accumulator
AX 16-bit accumulator
CX=Count register
DS=Data segment
ES–Extra segment
Above/below refers to unsigned value
Greater–more positive
Less=less positive (more negative) signed values
if d=1 then "to" reg, if d=0 then "from" reg
if w=1 then word instruction, if w=0 then byte instruction

if mod=11 then r/m is treated as a REG field
if mod=00 then DISP=0,* disp-low and disp-high are absent
if mod=01 then DISP=disp-low sign-extended to 16-bits, disp high is absent
if mod=10 then DISP=disp-high: disp low
if r/m=000 then EA=(BX)+(SI)+DISP
if r/m=001 then EA=(BX)+(DI)+DISP
if r/m=010 then EA=(BP)+(SI)+DISP
if r/m=011 then EA=(BP)+(DI)+DISP
if r/m=100 then EA=(SI)+DISP
if r/m=101 then EA=(DI)+DISP
if r/m=110 then EA=(BP)+DISP*
if r/m=111 then EA=(BX)+DISP
DISP follows 2nd byte of instruction (before data if required)

*except if mod=00 and r/m=110 then EA=disp-high: disp-low

if s/w=01 then 16 bits of immediate data form the operand
if s/w=11 then an immediate data byte is sign extended to form the 16-bit operand
if v=0 then "count"=1, if v=1 then "count" in (CL)
x=don't care
z is used for string primitives for comparison with ZF FLAG
SEGMENT OVERRIDE PREFIX

| 0 0 1 reg 1 1 0 |

reg is assigned according to the following table

16-Bit (w=1)		8-Bit (w=0)		Segment	
000	AX	000	AL	00	ES
001	CX	001	CL	01	CS
010	DX	010	DL	10	SS
011	BX	011	BL	11	DS
100	SP	100	AH		
101	BP	101	CH		
110	SI	110	DH		
111	DI	111	BH		

Fig. 6: Table of instruction set summary continued

To keep compatibility with 8085, it is possible to add packed decimal bytes (two decimal numbers per byte) with a DAA instruction. Intel has gone one step further, like the Z-80, in that it provides in the 8088 a DAS instruction to deal with subtraction of decimal bytes. (Remember, in Z-80 the DAA instruction works for both.)

Apart from these, there is a possibility of adding decimal numbers which have one byte per digit, or numbers coded in ASCII code. As is well-known, numbers 0 to 9 are coded as 30 to 39 in this ASCII code. Thus, one byte is used for each decimal digit. Such ASCII coded numbers, or numbers which are stored in the right half of the byte, can be added or subtracted, by following the addition with AAA or AAS instructions. AAA means ASCII-adjust for addition and AAS means ASCII-adjust for subtraction. But one cannot add or subtract packed BCD word, because the DAA and DAS instructions cannot adjust for BCD word-addition or subtraction (only one byte).

Multiplication and division are possible for binary bytes, words and unpacked BCD digits, but not for packed BCD bytes. There are two instructions, one for signed 2's complement numbers and one for unsigned integers (binary).

MUL	DIV
IMUL	IDIV
AAM	AAD

AAM and AAD should follow the MUL or DIV instructions if the operands are unpacked (ASCII-coded) numbers. (See monitor program).

The logical instructions, AND, NOT OR and ExOR allow operands between registers, registers and memory. Both byte and word logic operations are possible. The sign, zero, carry and overflow flags are affected. There is also a TEST instruction which just does the AND operation on the two operands (reg/memory) affecting only the flag register, without affecting the values of the operands.

Among the rotate/shift instructions, the following 8085 instructions exist, with different notations.

8085	**8088**	
RAL	RCL	Rotate through carry left
RAR	RCR	Rotate through carry right
RLC	ROL	Rotate left
RRC	ROR	Rotate right

In the 8085, only the accumulator could be the operand. But here, it can be any register or even a memory byte, addressed indirectly via the register-addressing mode.

One more facility which is available is that in the rotate instructions multiple shift is possible. For example, instead of using four rotate instructions to shift one BCD digit left, this is done with a counter in CL register, previously loaded with 4. The ROL AX.N is the instruction (Op-code D3 C0) which will shift AX left as many bits as contained in CL register. Note that again both byte and word rotations are possible.

Four more additional rotate instructions are available which are:

SAL	Shift arithmetic left--enters a zero at right
SHL	Same as SAL (called Shift Left)
SAR	Shift arithmetic right
SHR	Shift right -enters a zero at the left most bit.

Fig. 5 illustrates these. Notably absent is the decimal digit rotate instruction, which is available in the Z-80.

Such BCD digit shifts can be managed however with CL=4, as mentioned above. All these can be used for byte or word operations (16 shifts) and can handle both register and memory operands.

String manipulation

The 8088 is particularly useful for string movement and checking.

LODS Byte	Loads string byte: Loads from the contents of memory pointed by the SI register in the data segment into register AL. After this, the contents of SI are incremented by one.
LODS Word	Loads a string word: As above, into AX. The contents of SI are incremented by two, to point to the next word.
STOS Byte	Stores as above, from AL into memory pointed by DI register in the extra segment (ES).
STOS Word	Stores a word from AX into memory pointed by DI register in the extra segment (ES).

The direction flag in the status register can be set to zero for incrementing (with a CLD instruction) or set to 1 for decrementing (with STD-set direction instruction), in order to do an incrementing of the SI/DI register or decrementing of the same. This enables a string to be transferred from its top or bottom end.

MOVS Byte	This does a single byte transfer between the two memory areas pointed by the source-index (SI) register and the destination index (DI) register. Note that the SI register addresses memory in the data segment and the DI register addresses memory in the extra segment. Here also, the direction flag could be incrementing or decrementing.
MOVS Word	This does a word transfer as above.
CMPS Byte or Word	This compares the byte or word pointed by the SI and DI registers, and uses the result to set the sign, zero, carry, overflow and parity flags.
SCAS Byte or Word	This compares the AL or AX register (byte or word) with the data byte or word addressed by the DI register in the extra segment memory area. The comparison sets the flags, as above.

All the above string instructions just transfer or compare a byte or word. If this has to be repeated to cater for a full-string transfer or scan, the following REP instruction is useful:

REP Op-code F2	The string sequence continues until CX contents decrement down to zero. So, by loading CX with a number, that many transfers or scans can be done.
REP Z or REP NZ	These instructions repeat the string transfer or scan conditionally until zero flag is set or not.

This enables scanning or transferring until a catchword is sensed, for example.

CALL, RETURN and JUMP instructions

Like the 8085, there are CALL and RETURN instructions but there are four different types of these instructions.

CALL	BRANCH	This call uses two post-bytes which are displacements (16-bit) from the point in the program.
CALL	BRANCH SEGMENT	This call is directed to another code-segment. It has four post-bytes, the first two for the exact address, the second two for the new CS address.

The op-code for the displacement based CALL is E8 and for the inter segment CALL is 9A followed by the post-bytes.

There is another indirect CALL within the same segment.

CALL indirect (register memory) (op-code FF) post-byte is 1 (mod 010 r, m)	The contents of any 16-bit register or the contents of any memory word become the calling address, **within the same segment.**

There is another CALL which is indirect, but outside the segment.

Call indirect inter-segment

op-code is again FF post-byte is (mod 011 r, m)	The contents of any register (16-bit) or that of any addressed memory word become the calling address

This is useful for high level language compilation.

Likewise, there are four RETURN instructions. The corresponding RETURN instruction must be used for the corresponding CALL.

There are totally 17 conditional branch instructions which are all listed in the table (Fig. 6). Particularly important is the JCXZ instruction which is a JUMP if CX register becomes zero. This enables loops to be implemented. These conditional jumps are all 8-bit displacement based and hence jump forward or backward by 127 bytes, like the Z-80's relative branch instructions.

There is an instruction called LOOP which is similar to the Z-80's DJNZ instruction. Here the CX register is decremented and the jump occurs if it is not zero.

In the LOOP Z or LOOP NZ instruction, an extra condition is involved: more than CX=0. If the zero-flag is zero or non-zero, and the CX is non-zero, then the jump occurs, otherwise the next instruction is executed.

There are five **un-conditional JUMP** instructions, to take a program anywhere within or outside the segment. Indirect jumps are also possible.

PUSH and POP instructions

Apart from register pushes and pops to and from the stack (all of which use the stack segment), it is also possible to PUSH an addressed memory word or byte into stack and POP it accordingly. For example, PUSH BX simply pushes the contents of BX register; PUSH (BX) pushes the contents of the memory pointed by BX. Corresponding POP instructions will have to be used with care.

SAHF and LAHF are two short instructions for exchanging between the flag register and the AH register. For example, the equivalent of PUSH PSW is:

LAHF	Move the flag register into AH
PUSH AX	Push both AL and AH into the stack

which is the equivalent for the 8085's PUSH PSW instruction. Similarly, POP PSW (8085) is equivalent to following:

POP AX	Get both AL and AH from stack
SAHF	Move AH back to flag register

8088 addressing modes

The 8088 offers an extensive selection of addressing modes. The following addressing modes are possible:

(i) **Direct addressing.** The address of the operand is given in the instruction itself.

MOV DATADDR, DX (DATADDR = 0 05 00, say)

A look at the instruction set table (Fig. 6) shows that for MOV reg/memory to/from reg. has the op-code format:

1 0 0 0 1 0 d w mod reg. r/m (2 bytes)

The movement is from register, hence d=0 as shown at the end of the table. w=1 for word movement (DX register). Thus the first op-code byte is 89 in hex. format. The second op-code byte is now to be formed. This is in three parts: mode, register code, r/m format of addressing mode.

For direct addressing, as shown at the end of the table (Fig. 6)

mode = 00, r/m = 110

The register code is 010 for DX. Hence the second byte is

00 010 110 which is 16. Hence the instruction code is

MOV DATADDR, DX 89 16 00 05

Note that the absolute address is got by adding the address 05 00 which follows the op-code bytes to the DATA-SEGMENT starting value. Let us assume that DS was set to 00 00 initially. (RESET operation makes all the segment registers, except CS register to 00 00.) Hence the absolute address is:

0 00 00	Data segment start address
05 00	
0 05 00	Absolute address in 1 megabyte memory

Note that the 05 00 is with respect to the starting point on the DS segment.

(ii) **Register indirect addressing.** In the 8085, memory was accessible using the H-L register pair as a pointer. MOV A,M meant that it fetched from (H-L), the parenthesis indicating 'contents of'. A similar addressing is provided in 8088, with extensions.

MOV AX, (BX)

is to move from memory pointed by BX register into AX. Note that BX is the equivalent of H-L pair in 8088.

We also can move from a displaced memory location. For example:

MOV AX, (BX + 5)

will move from the address pointed by BX, with 5 added to it. We can even have a 16-bit displacement, that means the actual address could be displaced by as much as 64k bytes from what is pointed by BX register!

The op-code for the above, will be:

1 0 0 0 1 0 d w mod reg r/m Displacement

It has 3 bytes (for an 8-bit displacement, within 255) and four bytes code for a 16-bit displacement. If there is no displacement as in MOV AX,(BX), then it has just 2 bytes.

Here we move from memory to register so that d=1, w=1 since it is a word movement.

First byte becomes 8B. For the second byte, mode=00 for no displacement. 'Register' is now AX, whose code 000 is fixed. Now comes the reg mem/field of this second byte. The footnote of the instruction set given shows that r/m=111 for (BX)+DISP. Hence the second op-code byte is 00000111 or 07

Thus, MOV AX, (BX) is 8B 07

Similarly, MOV AX, (BX+5) is 8B 47 05

Note that mode=01 for one 8-bit byte of displacement.

(iii) **Indexed addressing and based indexed addressing (Fig. 7).** As in the Z-80, we have index register SI and DI and also another base pointer (BP), to access the stack segment memory.

MOV CX,(SI)

has the op-code

100010 dw mod reg.r/m

as 10001011 00001100 or 8B 0C.

The value in SI index register is added to the DS segment start address to get the effective absolute address in the one megabyte area. Note that if we have MOV CX,(DI), the op-code becomes

8B 00001101 or 8B 0D.

If we want MOV CX, (DI+5) say, in order to get the value of the word from the fifth displaced memory address from what the DI points to, then the op-code becomes

8B 01001101 or 8B 4D. 05

which has three bytes of code.

Based indexed mode uses the base-register BX (or BP if stack segment is to be accessed) in addition to any of the index registers.

MOV CX,(BX)+(SI)

will move the contents of the address formed by summing up the BX and SI contents.

An 8-bit or 16-bit displacement can be added as well. The data is fetched in the DS segment memory space.

If BP is used in the above instruction, the data will be fetched from the stack segment.

The op-code for the above instruction is got from: [illegible]0000[illegible]0 or 8B 08. The r/m field is 000 for (BX)+(SI).

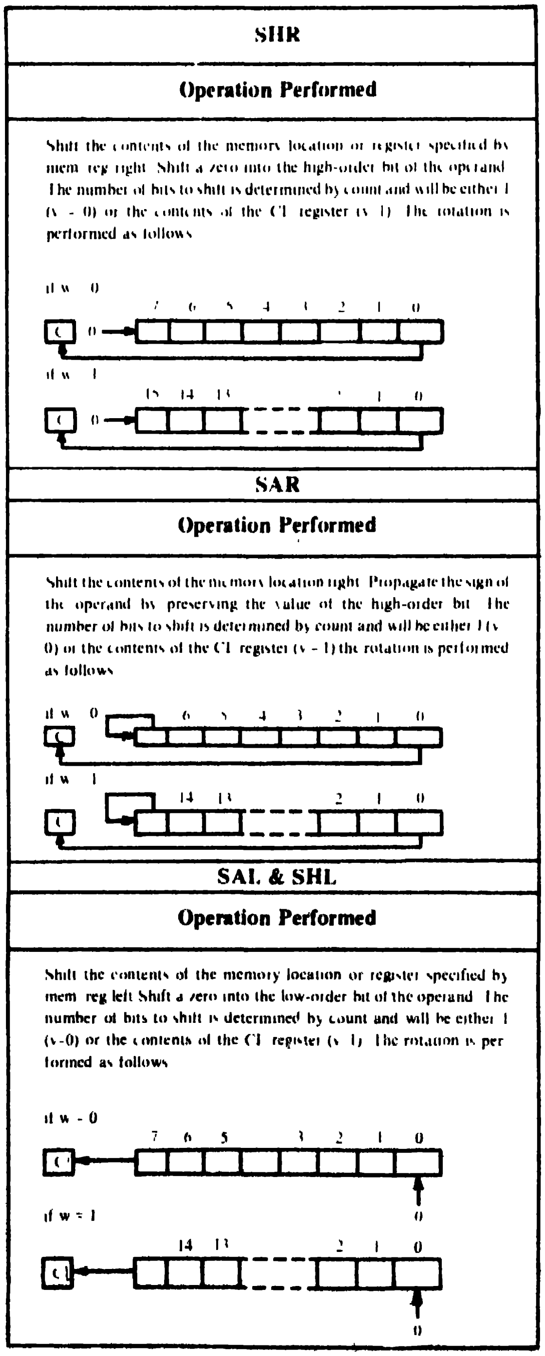
(iv) **Immediate addressing mode.** In an immediate mode, we can move a byte or a word, either to a register (8-bit or 16-bit) or to a memory byte or word.

If we want to move to memory 05 00 in DS space the word 1234, so that 05 00 contained 34, and 05 01 contained 12, then we use

MOV ADDR, DATA

1100011w mod 000 r/m data-low data-high is the op-code.

Here w=1 for word, mode=00 (no DISP), and r/m could be SI based. Then r/m=100. Thus the value 00 05 should be



SHR

Operation Performed

Shift the contents of the memory location or register specified by mem reg right. Shift a zero into the high-order bit of the operand. The number of bits to shift is determined by count and will be either 1 (v = 0) or the contents of the CL register (v = 1). The rotation is performed as follows

SAR

Operation Performed

Shift the contents of the memory location right. Propagate the sign of the operand by preserving the value of the high-order bit. The number of bits to shift is determined by count and will be either 1 (v = 0) or the contents of the CL register (v = 1) the rotation is performed as follows

SAL & SHL

Operation Performed

Shift the contents of the memory location or register specified by mem reg left. Shift a zero into the low-order bit of the operand. The number of bits to shift is determined by count and will be either 1 (v = 0) or the contents of the CL register (v = 1). The rotation is performed as follows

Fig. 7: Additional Shift/Rotate instructions in 8088.

loaded previously in SI. The code becomes C7 04 34 12.

In order to load SI with the value 05 00, we use the register-immediate load instruction

MOV SI,DATA which is

1011 w reg DATA

For SI, reg.=110, w=1, so that the op-code becomes

BE 00 05

with three bytes of code.

For loading the segment registers, there is the instruction MOV Reg to SEG-Reg. = 8E mod-0, reg r/m

For example, MOV ES,AX will have the code

8E 11000000 since mod=11 for register to register movements, 00 is code for ES and AX has code 000.

Similarly MOV DS, DX will have

8E 11011010 since mode=11 for register-register movements, 11 is code for DS, and 010 is code for DX.

These codes are all given at the footnote of the table (Fig. 6).

A segment override prefix can be used to any instruction if we want to access any other segment.

For example, SEG ES

will access the extra segment memory space when preceded. Otherwise DS space will alone be used for data access from memory. In string operations, MOVS or CMPS string instructions use both DS and ES as mentioned earlier and this segment override prefix should not be used. Also, all program memory instructions will be only in CS segment and cannot be overridden.

Monitor program and kit use

The monitor program whose listing is given is written on similar lines as that of the 8085 monitor. 8085 equivalent instructions are used as far as possible.

Readers would do well to compare this listing with that of the 8085 monitor given in Jan. 82 issue of EFY. Familiarity with 8088 will thus be obtained.

Note that upon RESET, the 8088 sets its CS register to FF FF and hence the program memory area should be at the highest end of the one megabyte memory. Since, in this kit, we have left free the A16-A19 addresses, the first F in CS register is a 'don't care' digit for us. Hence the EPROM (2732) is selected at FF FF0 and thus the first jump instruction is placed in the last (Fth) page of the EPROM at F0. This is an inter-segment jump which jumps to F5 00, i.e., to the 5th page on the 2732. The CS register is simultaneously made 00 00. Thus, all further program has identical values for CS,DS,ES,SS, all of which are 00 00.

This, however, does not mean that a user writing a program on the kit should have only 00 00 for all these segment registers. One can redefine their values. The user memory RAM occupies the first 2k space (00 00-07 FF).

Several programs are given below, which illustrate some of the typical 8088 instructions. All these are tested programs. A clock program as usual is given at the end. This can be compared with the 8085 clock program given in Feb. 82 EFY.

1. A PROGRAM TO FIND THE AVERAGE OF A NUMBER OF BYTES

Address		Mnemonics	Code	Comments
04 00		MOV SI,00 05	BE 00 05	SI points to 05 00 where the numbers are stored.
04 03		MOV CX,0B 00	B9 0B 00	CX stored with number; (0B) bytes to be averaged
04 06		PUSH CX	51	Save CX register
04 07	TOP	ADD AL,(SI)	02 04	Add the first no. with AL
04 09		ADC AH,00	80 D4 00	And then ADD carry into AH
04 0C		INC SI	46	Increment SI to get the next number.
04 0D		LOOP	E2 F8	Decrement CX and return to loop top if non-zero.
04 0F		POP CX	59	Restore original CX value
04 10		DIV CL	F6 F1	Divide AX by CL.
04 12		OUT AL,04	E6 04	Output the averaged number on Port-4
04 14		HLT	F4	

The numbers to be averaged are stored in 05 00 onwards.

```
Address
05 00     . .01  02  03  04  05  06  07  08
   08        09  0A  0B
```

Result: The number 66 is the average. In hexadecimal code, it is 41. This is what we get on Port-4 LEDs.

2. BINARY MULTIPLICATION

Address	Mnemonics	Code	Comments
04 00	MOV AL,08	B0 08	Multiplicand -08 is in AL
04 02	MOV CL,05	B1 05	Multiplier -05 is in CL
04 04	MUL CL	F6 E1	Multiply AL by CL contents
04 06	MOV 05 00,AX	A3 00 05	Store result in 05 00
04 09	HLT	F4	

Upon executing the program and then looking at 05 00, we get 28 correctly. 05 01 contains 00.

3. MULTIPLICATION OF BCD (DECIMAL) NUMBERS IN UNPACKED FORMAT (ONE DIGIT/BYTE).

Enter two unpacked BCD numbers, low order first in 05 00 and 05 01.

Multiplier is one BCD digit in BL register.

Result will be the product of these three digits, low order first from 06 00 onwards.

04 00	MOV SI, 00 05	BE 00 05	SI points to low-order digit of 2-digit multiplicand
04 03	MOV DI,00 0	BF 00 06	DI points to result
04 06	MOV BL,09	B3 09	Multiplier number 09 is stored in BL register
04 08	MOV AL,(SI)	8A 04	Get low order digit of multiplicand
04 0A	MUL AL,BL	F6 E3	Multiply (unsigned) AL times BL.
04 0C	AAM	D4 0A	Adjust result to 2- digit packed BCD product, unpacked, in AL,AH

```
04 0E     MOV (DI),AX      89 05    Store 2-digit partial
                                     product in result+0 and
                                     result+1
04 10     MOV AL,(SI+1)    8A 44 01 Get high order digit of
                                     multiplicand
04 13     MUL AL,BL        F6 F3    Multiply in binary
04 15     AAM              D40A     Adjust result for un-
  .                                  packed BCD
04 17     ADD AX,(DI+1)    03 45 01 Add partial product in
                                     binary (result+1) and
                                     (result+2)
04 1A     AAA              37       Adjust result to unpacked
                                     BCD
04 1B     MOV (DI+1),AX    89 45 01 Store result
04 11     HLT              F4
```

16-bit multiplication

We can multiply any register-word or memory-word with AX and the result will be in DX.AX.

```
04 00     MOV AX 03 E8      B8 E8 03 Number 1000 - 03E8
04 03     MOV CX 03 E8      B9 E8 03 Again by 1000, so get
04 06     MUL CX            F7 E1     the 1000×1000 product
04 08     MOV LABEL,AX      A3 00 05 Move AX in 05 00,05 01
04 0B     MOV AX,DX         8B C2
04 0D     MOV LABEL+2,AX A3 02 05 Move DX into 05 02,03
04 10     HLT               F4
```

We get from 05 00 onwards: 40 42 0F 00, which gives the product word (32-bit) as 000F4240, the equivalent of 1000,000. (1000,000 in binary=11110100001001000000.)

4. DIVISION

Binary division (byte division)

```
04 00     MOV AX, FF 00     B8 FF 00 Dividend 00FF is in AX
04 03     MOV CL,10         B1 10    Divisor in CL register
04 05     DIV CL            F6 F1    Now AX is divided by CL
04 07     MOV 05 00,AX      A3 00 05 Move AX into 0500, 0501
04 0A     HLT               F4       Halt.
```

The result will be FF/10, which gives a quotient of 0F and a remainder of 0F. For division, the quotient is in AL, remainder in AH.

Binary word division (32-bit/16-bit)

```
04 00     MOV AX,DATA1   B8 A0 86 32-bit number in DX AX
                                   (100000=00 01 86 A0)
04 03     MOV DX,DATA2   BA 01 00
04 06     MOV CX,DIVISOR B9 E8 03 Divisor (16-bit) by 1000
                                   (03 E8 in binary).
04 09     DIV CX         F7 F1    Divide by CX
04 0B     MOV LABEL,AX   A3 00 05 Move AX into 05 00
04 0E     MOV LABEL+2,DX 89 16 02 Move DX into 05 02
                         05
04 12     HLT            F4       Halt.
```

Result will be 100,000/1000=100, which is 00 64 in binary. This will be stored in 05 00,05 01. Remainder is 00 00, in 05 02 and 05 03.

Unpacked BCD numbers division

```
04 00     MOV AX, 06 05     B8 06 05 Dividend number 56 is
                                      stored in AX register
04 03     MOV BL,08         B3 08    Divisor 08 stored in BL
04 05     AAD               D50A     Adjust for ASCII
                                      numbers (unpacked
                                      BCD numbers)
04 07     DIV BL            F6 F3    Divide AX by BL
04 09     MOV 05 00, AX     A3 00 05 Store result in 05 00
04 0C     HLT               F4       Halt.
```

Result in 05 00 will be 07.

Division of 16-bit numbers involves the special register pair (16+16 = 32-bit) DX.AX. The remainder will come in DX, quotient in AX.

5. STRING TRANSFER INSTRUCTION

(a) Transfer one page of FF bytes

```
04 00          MOV SI, 05 00   BE 00 05 SI register points to
                                         source area 05 00
04 03          MOV DI, 06 00   BF 00 06 DI register points to
                                         destination area
04 06          MOV CX, 00 FF   B9 FF 00 CX is stored with the
                                         number FF (a page)
04 09          CLD             FC       Clear direction flag for
                                         autoincrement in string
                                         instruction which
                                         follows
04 0A     Pt P:MOVS B          A4       Moves the contents of
                                         the SI pointer to DI
04 0B          LOOP P          E2 FD    Decrement CX, return
                                         to top of loop if not
                                         zero
04 0D          HLT             F4       Halt.
```

The contents of 05 page in RAM would have got transferred into 06 page after this program is run.

(b) Instead of the LOOP instruction in the above, we can also use the REPEAT (REP) instruction as follows:

```
04 0A          REP
04 0B          MOVS B          A4       Move the whole string
                                         using REPEAT until
                                         CX=0
```

(c) String transfer and test while transferring:

```
04 00          CLD             FC       Clear the direction flag
04 01          MOV SI, 00 06   BE 00 06 SI points to a source
                                         string at 06 00
04 04          MOV DI 00 05    BF 00 05 DI points to 05 00, the
                                         place where it is to be
                                         moved.
04 07          MOV CX, FF 00   B9 FF 00 CX is stored with the
                                         code FF
04 0A        P:LODB            AC       The contents of SI area
                                         got into AL
04 0B          STOB            AA       Then moved into DI area
04 0C          TEST AL, FF     A8 FF    Test if AL is = FF
04 0E          LOOP NE, P      E2 FA    Loop until AL finds the
                                         code FF
04 10          HLT             F4       Halt.
```

The program will duplicate the contents of 06 page into 05, until it senses an FF in the former. Hence, one can load an FF at some location in 06 page and test the program.

Note that in string transfer, the destination index points to the extra segment memory. But in our monitor we have made all segment registers as 00 00 and hence access within the same memory block.

(d) Table look-up using XLAT instruction:

Suppose a table of values is kept stored in 05 page starting from 00 address. Let us try to pick the fifth entry of such a table.

```
04 00      MOV BX, 05 00    BB 00 05 Point to memory via BX
04 03      MOV AL, 05       B0 05    AL contains the entry pt.
04 05      XLAT             D7
04 06      OUT 04           E6 04    Output on port-4, the
                                      looked-up value
04 08      HLT              F4
```

Now, after executing this program, the port-4 LEDs show the contents of 05 05.

8088 software interrupts

The 8088 has several types of interrupts. There is an INTR pin which is an external interrupt request pin. It is also possible to generate an interrupt in a program itself. For this an INT instruction is used. It is similar to the RESTART (RST) instruction of the 8085. There, a single byte op-code caused a jump to the 00 page location, such as 00 38 for RST-7 with the op-code FF. In 8088/86, the program jumps indirectly to the memory pointed by a vector in 00 to 03 pages.

The INT instruction pushes on the stack the PC,CS and flags. An IRET instruction in the interrupt service routine will restore these, after returning from such an interrupt.

The pages 00 to 03, totally 1024 bytes, can contain 256 vector addresses (4 bytes per vector; 2 bytes for jump address; 2 bytes for code segment). Thus 256 software interrupts are permissible.

However, some of the interrupt vectors are reserved for certain functions. For example, the first vector which is at 00 00 has:

00	00	Low address and	of interrupt service routine for
00	01	High address	overflow upon division (divide by 0)
00	02	Low part	of code segment in which you might
00	03	high part	have written a routine to be executed when DIV by 0 occurs.

Thus the first software interrupt is reserved for taking suitable action whenever a divide-by-zero occurs. Hence it is called a type-0 interrupt. It automatically occurs upon division by zero. For example:

```
04 00      MOV AX FF 10     B8 FF 10 Move AX with the value
                                      10 FF (some number).
04 03      MOV CL,00        B1 00    Make the divisor pur-
                                      posely a zero
04 05      DIV CL           F6 F1    Divide by CL (a zero)
04 07      MOV LABEL, AX    A3 00 05 Move quotient and re-
                                      mainder in 05 00 and
                                      05 01
04 0A      HLT              F4
```

Also load the interrupt service routine to take necessary action upon a division by zero occuring.

```
00 00      00                        Start address of division
00 01      06                        by-zero interrupt service
                                      routine
00 02      00                        Code segment value is
                                      00 00
00 03      00
06 00      MOV AL,EF        B0 EE    Move a flag EE in AL.
06 02      OUT AL,04        E6 04    Output the error flag on
                                      port-4 LEDs
06 04      IRET             CF       Program returns
```

Upon executing the division program at 04 00, the port-4 LEDs show up as EE, indicating that division by zero was attempted. No division is really performed.

Type-1 interrupt (single step mode)

Type-1 software interrupt vector which is stored in 00 04 to 00 07 (program counter and code segment values as before) is to have an interrupt routine which enables debugging a program instruction by instruction. This interrupt is maskable and will work only if the TF bit in the flag register (8th in the 16-bit flag) is set. So, in order to do single stepping of instructions, one has to set the TF flag, write an interrupt service routine for debugging and load the addresses 00 04 to 00 07 with the address code-segment values of this routine. For example,

```
04 00       PUSH F          9C       Push the flags on to stack
04 01       POP AX          58       Move the flags into AH
                                      and AL
04 02       OR AH,01        80 CC 01 Set the 8th bit (0th bit in
                                      AH) to 1. This is for
                                      setting TF flag sub-
                                      sequently
04 05       PUSH AX         50       Push this altered flag
                                      value on stack
04 06       POP F           9D       Get the TF-set flags on
                                      to the flags register.
04 07       MOVAL,02        B0 02    Hereafter the program
                                      which is to be single-
                                      stepped follows: Let
                                      AL=02
04 09    P: INC AL          FE C0    Increment AL
04 0B       JMP P           EBFC     Jump to loop
```

After entering the above program, the interrupt vector as well as the service routine for single step are loaded (at 06 00).

```
00 04 00
00 05 06
00 06 00
00 07 00
06 00       OUT AL 04       E6 04    Output AL on port-4
                                      LEDs
06 02       POP 00 05       8F 06 00 Pop the stack to get at
                                     05       the previous Prog. Ctr
                                      value at some memory,
                                      say, 05 00
06 06       PUSH 00 05      FF 36 00 Push it back again in
                                     05       place
06 0A       PUSH AX         50       Push AX
06 0B       PUSH BX         53       Push BX
06 0C       MOV BX,00 05    8B 1E 00 Move the contents of
                                     05       05 00 (the previous
                                      prog. counter) into BX
```

```
                                    so that the monitor
                                    software display can
                                    show it
06 10      CALL KBD      9A 80 F2 Call monitor display
                         00 00     prog
06 15      POP BX        5B       Restore register set
06 16      POP AX        58
06 17      IRET          CF       Return from interrupt
```

Now execute the program at 04 00 as usual. The program advances step by step after reaching 04 09 address and the keyboard can be pressed (any hex. key) to step it. In this sample program, it just jumps between the addresses 04 09, 04 0B (because it has a loop there).

Type-2 interrupt

The special instruction INT (op-code CC) will cause vectoring to the address in 00 page at 0C. This is not maskable, unlike the single step interrupt.

Type-2 interrupt is a non-maskable interrupt which is got by a low to high pulse on NMI pin. It vectors to the address 08 on page 0.

Other interrupts! The instruction CD xx will vector to the address on zero page given by 4 times xx.

The following program illustrates it:

```
04 00      INT             CD 05
04 02      HLT             F4
05 00      MOV AL, FLAG    B0 CC    Move a flag, say CC in AL
05 02      OUT AL, 04      E6 04    Output on port 04
05 04      HLT             F4
```

Then load the 00 page at the corresponding vector address of 05 × 20 or 14 Hex.

```
00 14      00
00 15      05
00 16      00
00 17      00
```

Upon executing the program at 04 00, the port-4 LEDs show CC.

Thus there is a possibility of loading any value up to FF in the above INT instruction op-code (in the above, it was 05) and thus provide 256 interrupts. However, as seen earlier, some of the interrupt vectors are reserved for divide by 0, single step, etc.

Vector 0	Divide by 0
Vector 1	Single step
Vector 2	Non-maskable interrupt
Vector 3	INT instruction (code CC)
Vector 4	INTO instruction-interrupts upon 'overflow in 2's complement arithmetic
Vectors 5-31	Reserved by Intel in use for their software
Vectors 32-255	Usable by programmer with INT xx instruction.

Conclusion

With a simple board and using the same I/O board cum keyboard, one can practise the powerful 8088 micro- and develop programs for control applications.

CLOCK PROGRAM ON 8088 KIT

```
04 00        MOV SI, 05 00   BE 00 05 Point to 05 00 the
                                       address where hours,
                                       mins, secs are stored
04 03        MOV BH,(SI)     8A 3C    Take hours in BH register
04 05        MOV BL,(SI+1)   8A 5C 01 Take minutes in BL
                                       register
04 08        MOV CH,(SI+2)   8A 6C 02 Take seconds in CH register
04 0B   A    MOV AL,CH       8A C5    Bring seconds into AL register
04 0D        ADD AL,01       04 01    Add one to seconds
04 0F        DAA             27       Make it a decimal
                                       number
04 10        MOV CH,AL       8A E8    Move incremented
                                       seconds to CH
04 12        CMP AL,60       3C 60    Have 60 seconds gone by?
04 14        JZ R            74 0F    If so, jump to point R below
04 16   P.   MOV AX,10 02    B8 10 02 If not enter the loop
                                       below
04 19   Q.   PUSH AX         50       02 10 times
04 1A        CALL SOFT-      9A 00 F2 Calls the monitor program
             WARE DISP       00 00
04 1F        POP AX          58       Software display routine
04 20        DEC AX          48
04 21        JNZ Q           75 F6
04 23        JMP A           EB E6    Jump after looping delay
                                       of 1 second to point A
04 25   R.   MOV CH,00       B5 00    Clear seconds to zero
04 27        MOV AL,BL       8A C3    Move old minutes value
                                       to AL
04 29        ADD AL,01       04 01    Increase minutes by one
04 2B        DAA             27       Make it a decimal
                                       number
04 2C        MOV BL,AL       8A D8    Move incremented
                                       minutes to BL
04 2F        CMP AL,60       3C 60    See if minutes have
                                       reached 60
04 30        JNZ P           75 E4    If not, go to R
04 32        MOV BL,00       B3 00    If so, clear BL register
04 34        MOV AL,BH       8A C7    And load AL with hours
04 36        ADD AL,01       04 01    Increase hours by one
04 38        DAA             27        make it decimal number
04 39        MOV BH,AL       8A F8    Move incremented hours
                                       to BH
04 3B        CMP AL,13       3C 13    Are the hours more than 12?
04 3D        JNZ P           75 D7    If not go to P to time-loop
04 3F        MOV BH,01       B7 01    If yes, make hours to read
                                       as 01
04 41        JMP P           EB D5    Jump to point P time
                                       loop
```

Enter the hours in 05 00,
Enter minutes in 05 01,
Enter seconds in 05 02.

Display contents.		
	rightmost two digits	Seconds,
	middle two digits	minutes,
	left most digits	hours.

Execute the program at 04 00.

This program involves all byte operations only and hence the program is exactly similar to clock program given for the 8085. The length of the program is greater than that for the 8085, because of two-byte instructions predominantly used in 8088. Thus, the power of the 8088 is not shown well in byte operations.

8088 MONITOR PROGRAM LISTING

```
 Address       Hex. Code                     Mnemonics
HI LOW
FF  F0      EA  00  F5  00  00             JMP, BRANCH,
                                             SEGMENT
```

MAIN PROGRAM

```
 Address    Hex. Code                          Mnemonics
F5  00      BC  FF  07                         MOV SP, DATA 16
F5  03      BB  00  04                         MOV BX, 00 04
F5  06      8A  2F                    Scan. 2  MOV CH, (BX)
F5  08      9A  80  F2  00  0(        Scan. 1  CALL KBD
F5  0D      3C  40                             CMP AL, 40
F5  0F      73  08                             JNB To Pt. D
F5  11      B1  04                             MOV CL, 04
F5  13      D2  E5                             SAL CH, N
F5  15      0A  E8                             OR CH,AL
F5  17      EB  EF                             JMP TO SCAN 1
F5  19      3C  42                      Pt. D  CMP AL, 42
F5  18      75  04                             JNZ To Pt. F
F5  1D      8A  DD                             MOV BL, CH
F5  1F      EB  E5                             JMP To SCAN 2
F5  21      3C  41                      Pt. E  CMP AL, 41
F5  23      75  04                             JNZ To Pt. F
F5  25      8A  FD                             MOV BH, CH
F5  27      EB  DD                             JMP To Scan 2
F5  29      3C  44                      Pt. F  CMP AL,44
F5  2B      75  03                             JNZ Pt. P
F5  2D      4B                                 DEC BX
F5  2E      EB  D6                             JMP To Scan. 2
F5  30      3C  47                      Pt. P  CMP AL,47
F5  32      75  05                             JNZ Pt. G
F5  34      88  2F                             MOV (BX), CH
F5  36      43                                 INC BX
F5  37      EB  CC                             JMP To Scan. 2
F5  39      3C  43                      Pt  G  CMP AL, 43
F5  3B      75  C8                             JMP To Scan. 2
F5  3D      A1  00  F6                         MOV AX, 00 F6
F5  40      E7  01                             OUT AX, PORT-01
F5  42      FF  E3                             JMP BX
```

SOFTWARE DISPLAY ROUTINE

```
F2  00      51                                 PUSH CX
F2  01      9C                                 PUSH F
F2  02      8A  C7                             MOV AL, BH
F2  04      24  F0                             AND AL, F0
F2  06      B1  04                             MOV CL, 04
F2  08      D2  C8                             ROR AL, N
F2  0A      8A  D0                             MOV DL,AL
F2  0C      B0  7F                             MOV AL, 7F
F2  0E      E6  01                             OUT AL, 01
F2  10      E8  4D  00                         CALL seg. display
                                                (F2 60)
F2  13      8A  C7                             MOV AL, BH
F2  15      24  0F                             AND AL, 0F
F2  17      8A  D0                             MOV DL, AL
F2  19      B0  BF                             MOV AL, BF
F2  1B      E6  01                             OUT AL, 01
F2  1D      E8  40  00                         CALL seg. display
F2  20      8A  C3                             MOV AL, BL
F2  22      24  F0                             AND AL, F0
F2  24      B1  04                             MOV CL, 04
F2  26      D2  C8                             ROR AL, N
F2  28      8A  D0                             MOV DL, AL
F2  2A      B0  EF                             MOV AL, EF
F2  2C      E6  01                             OUT AL, 01
F2  2E      E8  2F  00                         CALL seg. display
F2  31      8A  C3                             MOV AL,BL
F2  33      24  0F                             AND AL,0F
F2  35      8A  D0                             MOV DL, AL
F2  37      B0  F7                             MOV AL, F7
F2  39      E6  01                             OUT AL, 01
F2  3B      E8  22  00                         CALL seg display
F2  3E      8A  C5                             MOV AL, CH
F2  40      24  F0                             AND AL, F0
F2  42      B1  04                             MOV CL, 04
F2  44      D2  C8                             ROR AL, N
F2  46      8A  D0                             MOV DL, AL
F2  48      B0  FD                             MOV AL, FD
F2  4A      E6  01                             OUT AL, 01
F2  4C      E8  11  00                         CALL seg. display
F2  4F      8A  C5                             MOV AL, CH
F2  51      24  0F                             AND AL, 0F
F2  53      8A  D0                             MOV DL, AL
F2  55      B0  FE                             MOVAL, FE
F2  57      E6  01                             OUT AL, 01
F2  59      E8  04  00                         CALL seg. display
F2  5C      9D                                 POPF
F2  5D      59                                 POPCX
F2  5E      CB                                 RET (inter-segment)
```

SEGMENT DISPLAY ROUT

```
F2  60      B6  F2                             MOV DH, F2
F2  62      B0  F0                             MOVAL, F0
F2  64      0A  D0                             OR DL, AL
F2  66      8B  F2                             MOV SI, DX
F2  68      8A  04                             MOVAL, (SI)
F2  6A      E6  02                             OUT AL, 02
F2  6C      BA  3F  00                         MOV DX, 3F 00
F2  6F      4A                          Pt P:  DEC DX
F2  70      75  FD                             JNZ disp 8 to, pt P
F2  72      B0  00                             MOV AL, 00
F2  74      E6  02                             ·OUT AL, 02
F2  76      C3                                 RET (displacement
                                                based)
```

KEYBOARD SUBROUTINE:

```
F2  80      E4  02                        KBD  IN AL, 02
F2  82      0A  C0                             ORAL, AL
F2  84      78  FA                             JS disp 8 to KBD
F2  86      E8  36  00                         CALL Time display
                                                (F2BF)
F2  89      E4  02                     LOOP F  IN AL, 02
F2  8B      0A  C0                             OR AL, AL
F2  8D      9A  00  F2  0   00                CALL software display
F2  92      79  F1                             JNS TO LOOP I
F2  94      E8  28  00                        CALL TIME DELAY
F2  97      E4  02                             IN AL 02
F2  99      0A  C0                             OR AL, AL
F2  9B      79  EC                             JNS, TO LOOP I
F2  9D      34  C0                             XOR AL, C0
F2  9F      24  4F                             AND AL, 4F
F2  A1      CB                                 RET (inter-segment)
```

TIME DELAY ROUTINE:

```
F2  BF      50                                 PUSHAX
F2  C0      9C                                 PUSHF
F2  C1      B8  FF  09                         MOV AX, FF 09
F2  C4      48                          Pt. A: DEC AX
F2  C5      75  FD                          JNZ TO PT.A (disp 8)
F2  C7      9D                                 POPF
F2  C8      58                                 POP AX
F2  C9      C3                                 RET (displacement)
                                                based)
```

LOOK UP TABLE FOR SEG

```
F2  F0      7E                                 0
F2  F1      0C                                 1
F2  F2      B6                                 2
F2  F3      9E                                 3
F2  F4      CC                                 4
F2  F5      DA                                 5
F2  F6      FA                                 6
F2  F7      0E                                 7
F2  F8      FE                                 8
F2  F9      CE                                 9
F2  FA      EE                                 A
F2  FB      F8                                 B
F2  FC      72                                 C
F2  FD      BC                                 D
F2  FE      F6                                 E
F2  FF      E2                                 F
```

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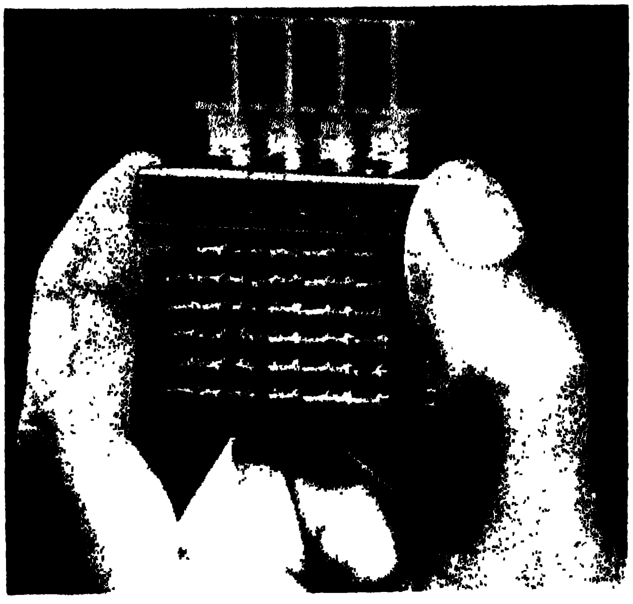

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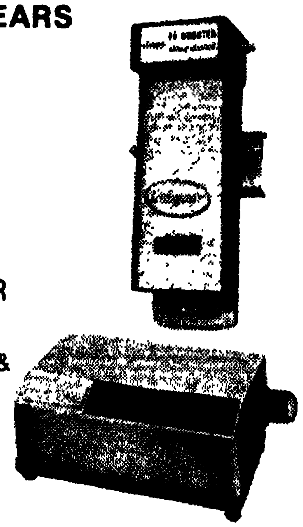

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Comparative Study of Computer Languages

Relational and Logical Operators

Part VII

R. Ramaswamy

In addition to the arithmetic operators which we have seen earlier, FORTRAN provides for six relational operators in order to make comparisons between variables, constants and expressions. The following is the coding scheme and the meaning of the six relational operators:

FORTRAN Coding Scheme to Represent the Operations	Meaning of the Operations
A .GT. B	A is greater than B
A .LT. B	A is less than B
A .EQ. B	A is equal to B
A .NE. B	A is not equal to B
A .LE. B	A is less than or equal to B
A .GE. B	A is greater than or equal to B

We see that the relational operators are coded in the mnemonic form. The period before and after the mnemonic name is a necessary punctuation. The operands on either side can be any valid arithmetic constants, arithmetic variables or arithmetic expressions. The only restriction is that the operands on the two sides must be of the same mode. If the left side is in integer mode, the right side should also be in the integer mode. If the left side is in the real mode, the right side also must be in the real mode. Mixed modes are not permitted in FORTRAN.

Relational, logical or boolean expressions

When arithmetic entities are connected with relational operators, we get a new class of expression called the relational expression or the logical expression or the boolean expression. Such expressions are not used for computing any numerical values. For example, let us say the value of A is 2.0 and B is 3.0. If we write A + B, we know that the expression leads to a numeric value of 5.0. If we write A .LT. B, then it has no numeric value.

We can only say whether the expression is TRUE or FALSE. In this case the expression A .LT. B is TRUE. If we write A .GT. B, then it is FALSE. An expression which can take only one of the two values, namely, TRUE or FALSE is called a logical expression or a boolean expression or a relational expression.

In deductive logic, an expression can take only one of the two values, namely, TRUE or FALSE. The computer can be asked to test the TRUE or FALSE value of a relational expression and branch off to different statements on the basis of the logical test.

The following are examples of valid logical expressions:

(a) [illegible]

(b) [illegible]

(c) [illegible]

[illegible]

(d) A .GE. 7.6

It must be noted that the two sides of a relational operator must be in the same mode. Otherwise, the computer will give a syntax error called mixed mode error.

The arithmetic expressions connected by the relational operator represent the simplest form of logical expression. The main difference between an arithmetic expression and a logical expression is that a logical expression can take only one of the two values, namely TRUE or FALSE, whereas an arithmetic expression can take infinite values.

Hierarchy of relational operators

All the six relational operators have the same hierarchy. It is not possible to go on combining the different operators in the same expression. Once a single relational operator is used to combine two arithmetic entities, the resulting expression becomes logical and it can no longer be connected with other relational operators. Logical expressions can be connected only with logical operators. But arithmetic operators take precedence over relational operators. Only after the arithmetic expressions on the two sides of a relational operator are computed, the relational operator will be performed.

Logical operators

Logical variables and logical expressions can be further combined only with logical operators. There are three logical operators, namely, NOT, AND and OR. The combination of logical variables with logical operators gives rise to logical expressions and they can again take only one of two values, namely, TRUE or FALSE.

Logical expressions and their meanings

We have said that in FORTRAN, variables also can be declared as logical. So, logical expressions can be formed in two ways. One, by combining arithmetic entities with relational operators and two, by combining logical variables with logical operators. Suppose the variables A and B are declared as logical in the beginning of the program by an explicit declaration statement.

The following examples illustrate how the logical operators are coded when combined with the operands:

FORTRAN Coding Scheme for Logical Operators	**Meaning of the Logical Operations**
A .AND. B	This combination can take only one of the two values, namely, TRUE or FALSE. The 'AND' combination of two logical entities is TRUE only if both the entities are TRUE, otherwise the combination is FALSE.
R. B	This combination also can take only one of the two values, namely, TRUE or FALSE. The 'OR' combination of two logical entities is TRUE if either both the entities are TRUE or any one of the entities is TRUE, otherwise the combination is FALSE.
.NOT. A	'NOT' is called an unary operator since it requires only one operand. The NOT operator always precedes the operand. The NOT operator simply reverses the values of the operand following it. If A had been originally TRUE, then .NOT. A is FALSE. If A had been originally FALSE, then .NOT. A is TRUE.

In FORTRAN, the relational and the logical operators are coded by placing periods immediately before and after the codes. This is a necessary punctuation in FORTRAN.

Examples to illustrate the logical operations

Suppose we have the following two logical statements. (A logical statement is one which can take one of the two values, namely, TRUE or FALSE.):

(i) December is the first month of a year.

(ii) January is the first month of a year.

We know that the first statement is FALSE and the second statement is TRUE.

Suppose we combine the two statements by AND and write: December is the first month of a year and January is the first month of a year. This single statement which is obtained by combining one FALSE statement and one TRUE statement by the AND operator is FALSE.

Suppose we combine the two statements by the OR operator and write, December is the first month of a year OR January is the first month of a year. This single statement which is obtained by combining one FALSE statement and one TRUE statement by the OR operator is TRUE.

So we can generalise and write that a combination of two statements connected by the AND operator will be TRUE only if both the statements are TRUE, and FALSE if any one of them is FALSE or both of them are FALSE. A combination of two statements connected by the OR operator will be TRUE if any one of the two statements is TRUE or both of them are TRUE, and FALSE only if both of them are FALSE.

Suppose we write January is NOT the first month of a year. The NOT operator operating on a statement simply reverses the TRUE or FALSE value of the statement. Before the insertion of the NOT operator, the statement was TRUE. After the insertion of the NOT operator, the statement has become FALSE. In effect, it amounts to saying that NOT FALSE is TRUE and NOT TRUE is FALSE.

The results of the three logical operators AND, OR and NOT can be represented in what are called TRUTH tables as shown below:

Truth Table for AND Operator

Value of the Logical Entity A	Value of the Logical Entity B	Value of A .AND. B
TRUE	TRUE	TRUE
TRUE	FALSE	FALSE
FALSE	TRUE	FALSE
FALSE	FALSE	FALSE

Truth Table for OR Operator

Value of the Logical Entity A	Value of the Logical Entity B	Value of A .OR. B
TRUE	TRUE	TRUE
TRUE	FALSE	TRUE
FALSE	TRUE	TRUE
FALSE	FALSE	FALSE

Truth Table for NOT Operator

Value of the Logical Entity A	Value of .NOT. A
TRUE	FALSE
FALSE	TRUE

It may be noted that the above tables are similar to the addition, multiplication and division tables in conventional algebra. In conventional algebra, the tables are very long since the number of values which a variable can take are infinite.

In logical algebra, the number of values which a logical variable or a logical expression can take is only two, namely, TRUE or FALSE. This is the reason why the logical operator tables are very short. These logical operations are more meaningful in life than the arithmetic operations. Suppose we have a situation as follows:

A student is evaluated by an internal and an external examination for 50 marks each. He must be declared passed if he gets 20 or more marks in the external and 50 or more in both the internal and the external put together, otherwise he must be declared failed. The logical statement which resolves this situation can be given as follows:

IF (EXTERNAL MARK $\geq$ 20) AND (INTERNAL MARK + EXTERNAL MARK $\geq$ 50) THEN DECLARE 'PASS' OTHERWISE DECLARE 'FAIL'.

In the above statement we find that the entities within the brackets are logical entities or logical expressions. It may be noted that the logical expressions in this case are formed by combining arithmetic entities with relational operators. The two logical entities are connected by the AND operator. The student will be declared 'pass' only if the two logical entities are TRUE, otherwise he will be declared 'fail'.

The above statement can be coded in the different computer languages for instructing the computer to compute and output. In the above case, the relational expressions within the brackets will be evaluated first and then the logical operation will be done. This means that relational operators will take precedence over the logical operators.

Hierarchy of operators

We have seen that there are five arithmetic operators (+, -, *, / and **), six relational operators (. GT., .LT., .EQ., .GE., .LE., and .NE.) and three logical operators (.NOT., .AND. and .OR.) in FORTRAN. All of them can appear in an expression. In such cases we must know the precedence or the priority or the sequence in which the various operations have to be performed.

The following is the hierarchy of all the operators in FORTRAN:

1. All operations within parantheses
2. Exponentiation operator
3. Multiplication and division operator in the order in which they occur from left to right.
4. Addition and subtraction operator in the order in which they occur from left to right.
5. All relational operators have the same priority. It must be noted that when two arithmetic variables or expressions are connected by a relational operator, the combination becomes a logical expression and logical expressions can be further combined only by logical operators.
6. .NOT. operator
7. .AND. operator
8. .OR. operator

Suppose one writes the following expression:

A+B+C .GT. D+E+F

The computer will not simply compare C with D, but it will evaluate the arithmetical expressions on the left hand side and the right hand side of the relational operator .GT. and compare the computed values of the two arithmetical expressions. This means that the arithmetical operations are performed first before the relational operations. The above can also be explicitly written as

(A+B+C) .GT. (D+E+F)

Suppose one writes an expression using the arithmetic variables A, B, C and D as follows:

.NOT. A .GT. B .AND. C .LT. D

A .GT. B will be performed first, C .LT. D will be performed next, .NOT. is performed on (A .GT. B) next and lastly the .AND. operator is performed. Thus we see that NOT is given precedence over AND.

Suppose one writes an expression using the arithmetic variables A, B, C and D as follows:

.NOT. A .GT. B .AND. C .LT. D .OR. A .EQ. B

The priority for the different operations are denoted explicitly by the following paranthesised expression:

(.NOT. (A .GT. B) .AND. (C .LT. D)) .OR. (A.EQ.B)

Thus we see that among logical operators, OR has the lowest precedence and NOT has the highest precedence.

FORTRAN permits a variable to be declared as logical and so logical expressions can be formed in FORTRAN combining not only arithmetic variables with relational operators, but also by combining logical variables with logical operators. It must be noted that logical variables must not be combined with either arithmetic or relational operators. Arithmetic variables can be combined with both arithmetic operators and relational operators.

Essentially, FORTRAN deals with three types of expressions, namely, integer, real and logical. The computer can be instructed to compute the values of these three types of expressions.

Relational operators in COBOL

In addition to the arithmetic operators which we have seen earlier, COBOL provides for six relational operators in order to make comparison between variables and constants.

The following is the coding scheme and the meaning of the six relational operators:

COBOL Coding Scheme to Represent the Relational Operators	Meaning of the Operations
A = B	A is equal to B
A > B	A is greater than B
A < B	A is less than B
A NOT = B	A is not equal to B
A NOT > B	A is not greater than B
A NOT < B	A is not less than B

The codes for the six relational operators are different from the codes used in FORTRAN, though their meanings are same. The operands on either side of the different relational operators can only be either variables or constants and not expressions. The spacing on either side of the operator is a must. Only data of the same type can be compared, i.e., numeric with numeric, alphabetic with alphabetic and alphanumeric with alphanumeric. Remember that the data types of every variable must have been described earlier.

Relational or logical expressions

When COBOL variables are connected by relational operators, we get a new class of expressions called relational or logical expressions. Computation of arithmetic expressions gives rise to numeric values, whereas the computation of logical expressions gives rise to non-numeric values, namely, TRUE or FALSE.

Remember that there are no logical variables in COBOL as in the case of FORTRAN. All the relational operators have the same hierarchy. Once two variables are connected by a relational operator, the combination becomes a logical expression and so it cannot be further combined with any relational operator, but can be combined only with logical operators.

The following are examples of valid relational or logical expr[illegible]

```
BASIC-PAY NOT < 500
MNO NOT= TNO
BALANCE NOT > CHECK-AMOUNT
```

It must be noted that the operands on either side of the relational operator can only be variables or constants.

Logical operators

As in the case of FORTRAN, there are three logical operators in COBOL. Though their meanings are the same, the ways of coding them are different. The three logical operators are NOT, AND and OR. They are coded as they are, without any periods on either side, as in the case of FORTRAN.

Remember that logical expressions alone can be combined with logical operators and the resulting expression is again logical. The operator truth tables are identical with FORTRAN. The AND combination of two logical statements will be TRUE only if both the statements are TRUE and the combination is FALSE if any one of them is FALSE or both of them are FALSE. The OR combination of two logical statements will be TRUE if any one of them is TRUE or both of them are TRUE and the combination will be FALSE only if both the statements are FALSE. The NOT operator simply reverses the TRUE or FALSE value of the original statement.

The hierarchy of the logical operators is the same as in FORTRAN, i.e., the operator NOT comes first, the operator AND comes second and the operator OR comes third. Parantheses can be used to give priority to any operation.

Relational operators in BASIC

There are six relational operators in BASIC in order to make comparisons between variables, constants and expressions.

The following is the coding scheme and the meaning of the six relational operators:

BASIC Coding Scheme to Represent the Relational Operators	Meaning of the Operations
A EQ B	A is equal to B
A LT B	A is less than B
A GT B	A is greater than B
A LE B	A is less than or equal to B
A GE B	A is greater than or equal to B
A NE B	A is not equal to B

The operands on either side of the different relational operators can be either variables or constants or expressions. The spacing on either side of the operator is a must. Only data of the same type can be compared, i.e., numeric with numeric and string with string.

All relational operators have the same hierarchy. But when once two arithmetic or string entities are connected by a relational operator, the combination becomes a logical expression, and a logical expression can be further combined only with logical operators.

The following are examples of logical expressions formed by combining arithmetic expressions with relational operators:

(a) A-B/C GT D*E + G/H
(b) A$ + B$ LT C$ + D$
(c) A + 23-67/78 GT 67.5*23.4+G*I
(d) "KRISHNAN" GT "RAMU'

As we have said before, logical expressions will result only in one of the two values, namely, TRUE or FALSE. In the above examples the expression on the left of the relational operator will be computed first, then the expression on the right of the relational operator will be computed. The computed values of the expressions on the left and right will then be subjected to the relational operator which will say whether the logical expression is TRUE or FALSE.

Logical operators

As in the case of FORTRAN and COBOL, logical expressions can be further combined only with logical operators. There are three logical operators, namely, NOT, AND and OR. Their meanings are the same as in the other languages.

Remember that there are no logical variables as in the case of FORTRAN. In FORTRAN logical variables are declared in the beginning of the program. In BASIC there are no such declaration statements for defining the nature of the variables. The hierarchy of logical operators is also the same as in the case of FORTRAN and COBOL. (NOT, AND and OR).

The AND combination of two logical statements will be TRUE only if the two logical entities are TRUE and the combination will be FALSE if any one is FALSE or both of them are FALSE. The OR combination of two logical entities will be TRUE even if any one of the entities is TRUE or both of them are TRUE, and FALSE only if both of them are FALSE. The NOT operator simply reverses the TRUE of FALSE value of the original logical statement.

The truth tables for the different operators are the same as for FORTRAN.

Relational operators in PL/1

There are eight relational operators in PL/1 in order to make comparisons between variables, constants and eight relational operators. The following is the coding scheme and the meaning of the eight relational operators.

PL/1 Coding Scheme to Represent the Relational Operators	Meaning of the Operations
A = B	A is equal to B
A > B	A is greater than B
A < B	A is less than B
A~>B	A is not greater than B
A >=B	A is greater than or equal to B
A~< B	A is not less than B
A <=B	A is less than or equal to B
A ~=B	A is not equal to B

Only the symbolic coding for the operators is allowed shown above. In the case of compound operators,there mu be no spacing between them. The operands on either side the different relational operators can be either variables constants or expressions. The spacing on either side of th operator is optional. Only data of the same type can b compared, i.e., numeric with numeric and string with strin

All relational operators have the same hierarchy. B once two arithmetic or string entities are connected by relational operator, the combination becomes a logica expression and a logical expression can be further combine only with logical operators. The arithmetic and the concate nation operators have higher precedence over the relation operators.

The computed value of a relational expression can tak only one of the two values, namely, TRUE or FALSE. Tha is why we call these relational expressions as logica expressions.

Logical operators

There are three logical operators in PL/1 having the sam meaning as in the other languages. Only difference is, the are coded in symbols instead of their mnemonic names. Th following is the coding scheme for the three logical opera tors of NOT, AND and OR

Mnemonic Names for the Logical Operators	Symbolic Coding Used in PL/1 for the Logical Operators
NOT	~
AND	&
OR	I or !

The following are examples of valid logical expressio formed by combining relational expressions with logic operators:

(a) IF A=B ! B=C ! C=A
(b) IF A+B = C+D & E+F = G+H

The expressions A+B, C+D, E+F and G+H can also b enclosed within parantheses to give the priority explicitl

The hierarchy of the logical operators is NOT, AND an OR. Parantheses can be used to override the implied prio rity. The meaning of the logical operators is the same as other languages.

Relational operators in PASCAL

There are six relational operators with which the arit metic variables, constants and expressions can be combine Character variables and constants also can be combin with relational operators. The following is the codi scheme of the different relational operators and their meanings.

Coding Scheme for Representing the Relational Operators	Meaning of the Relational Operations
A = B	A is equal to B
A > B	A is greater than B
A < B	A is less than B
A <> B	A is not equal to B
A <= B	A is less than or equal to B
A >= B	A is greater than or equal to B

All the relational operators have the same hierarchy. Integers and reals can be combined with the relational operators and so there is no mixed mode error as in the case of FORTRAN. Once the arithmetic expressions are connected by a relational operator, the combination becomes a logical expression and it can be further connected only by logical operators. So one cannot form expressions by going on combining the relational operators. The computed values of a relational or a logical expression can be only either TRUE or FALSE.

In PASCAL also, the relational operators are coded by symbols and not by mnemonic names. Mnemonic names for relational operators are allowed only in BASIC. The meaning of the different relational operators is the same as in the other languages. In PASCAL the equality operator is different from the assignment operator.

Logical operators

There are three logical operators in PASCAL, namely, NOT, AND and OR and they are coded as they are. Spacing must be left on either side of the logical operators. Their meanings are identical with that in other languages. In PASCAL we have logical variables as in the case of FORTRAN. Logical operators can be combined only with logical variables and logical expressions.

There are six arithmetic operators, six relational operators and three logical operators in PASCAL. Their priority is given as follows:

Precedence	Operators
First	NOT
Second	*, /, DIV, MOD, AND
Third	+, -, OR
Fourth	=, <>, <, >, >=, <=

The above scheme tells that the NOT operator has the highest priority and the relational operators have the lowest priority. The arithmetic operators along with AND and OR fall in between. Since the relational operators have the lowest precedence, they must be used with parantheses to prevent syntax errors. For example, if one writes

A < B OR C < D

it will be interpreted as A < (B OR C) < D, since the OR opera[illegible] has higher precedence over the relational operators. The expression B OR C is illegal, since B and C are arithmetic variables. So we must use parantheses and write as

(A < B) OR (C < D)

In the above example, we want the relational operators to precede the logical operator. So we use parantheses to change the precedence. Operations within parantheses get the highest priority.

Examples to illustrate logical computations

Let us now consider some examples to see how the logical or the boolean expressions in PASCAL are evaluated. The values of the arithmetic variables A, B and C are given as 2, 3 and 1 respectively. The value of the logical variable SWITCH is given as TRUE. The computed values of some expressions are given below:

(1) NOT SWITCH AND ((A > C) OR (B > A))	FALSE
(2) (A < B) OR (B >= C)	TRUE
(3) A = 2 OR B = 4	Illegal
(4) (A > B) OR (B < C)	FALSE

With this we end our study about the operators. In the next lesson we will study about the library functions or built-in functions and see how expressions can be written in the different languages starting from the algebraic form.

(To be continued next month)

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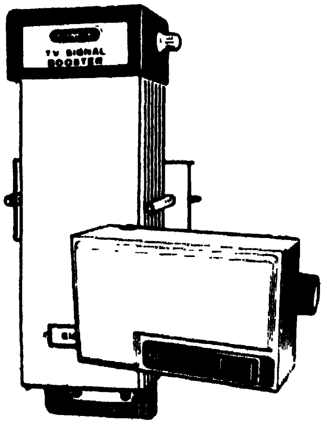

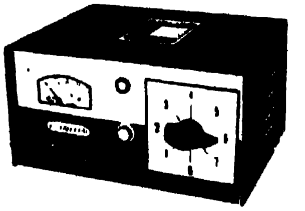

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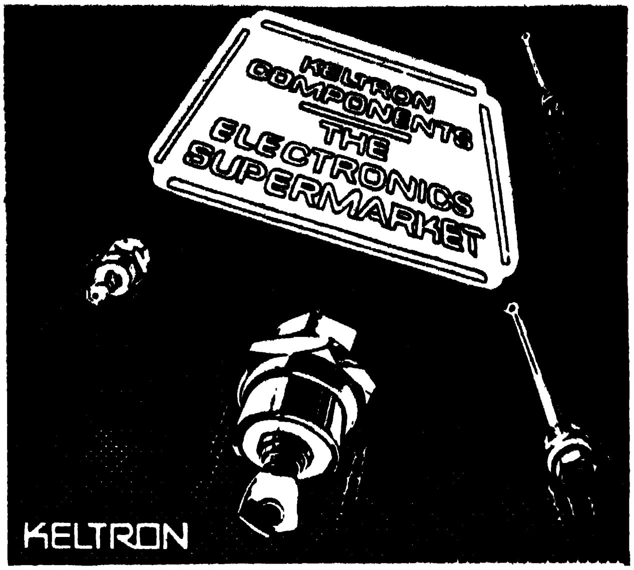

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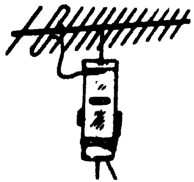

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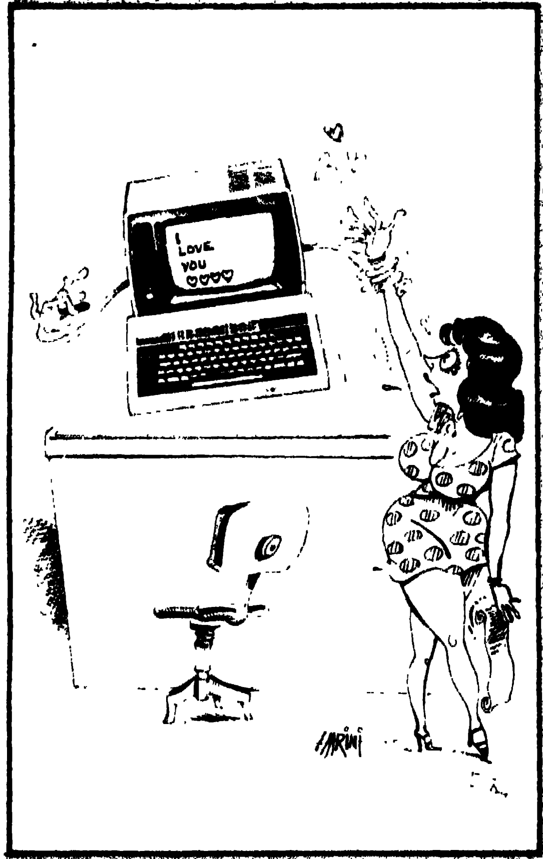

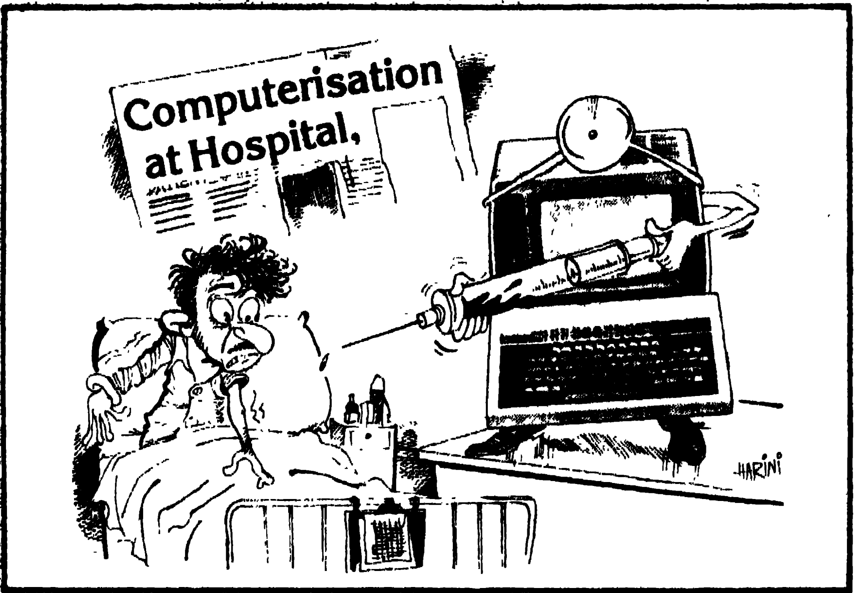

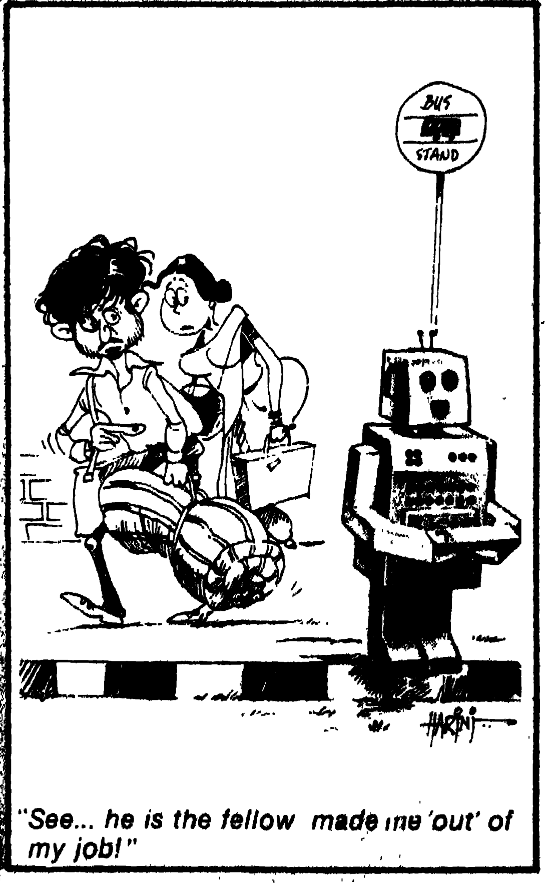

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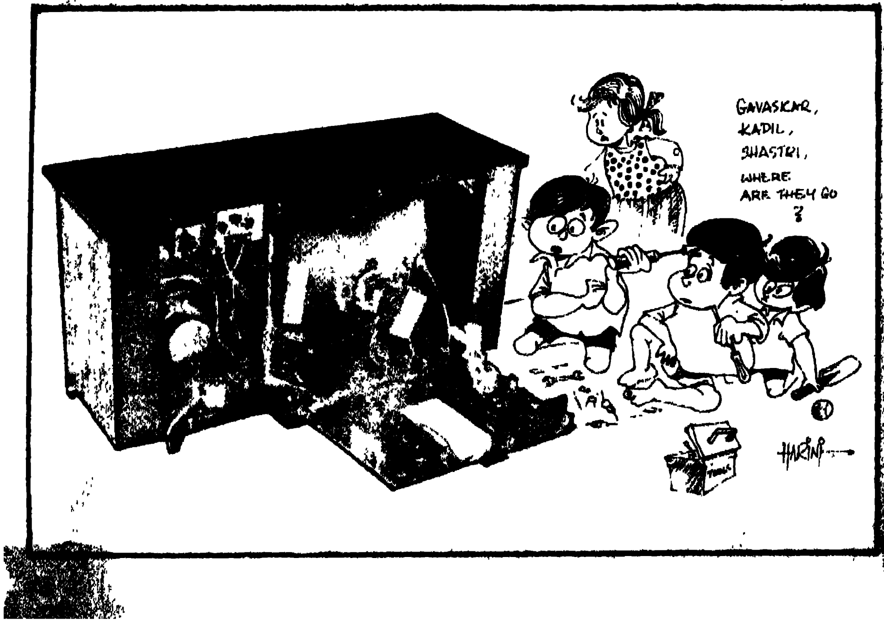
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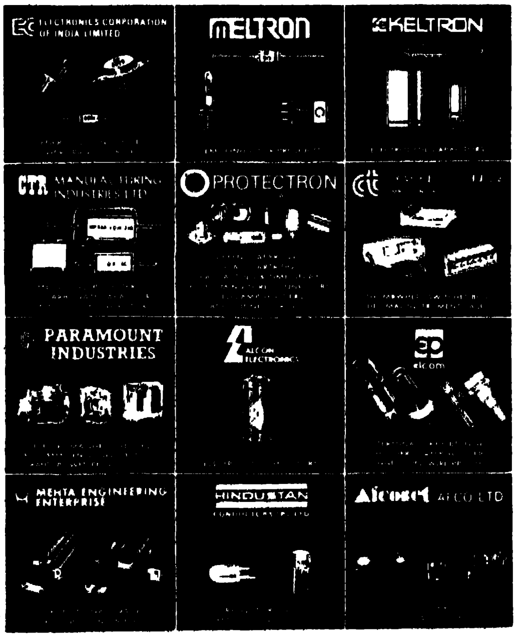
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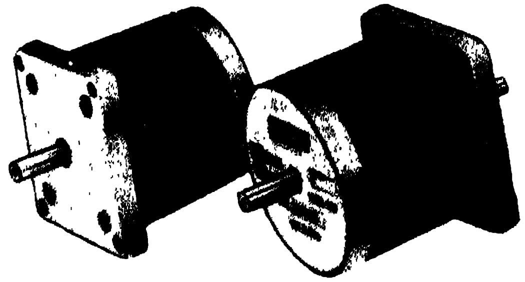

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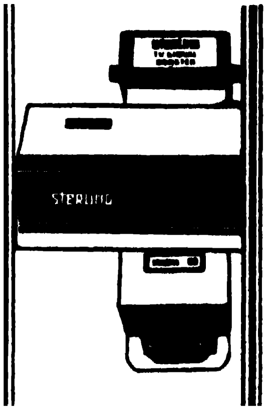

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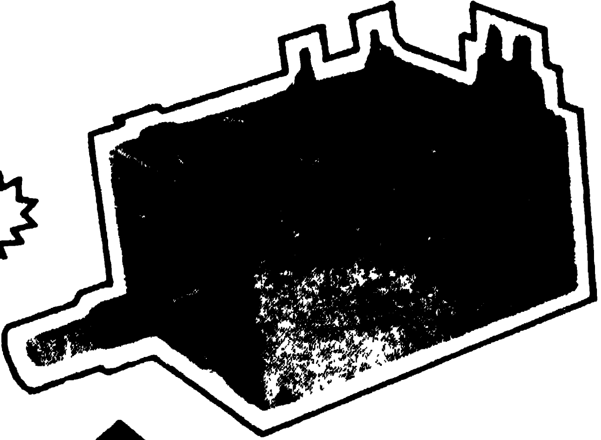

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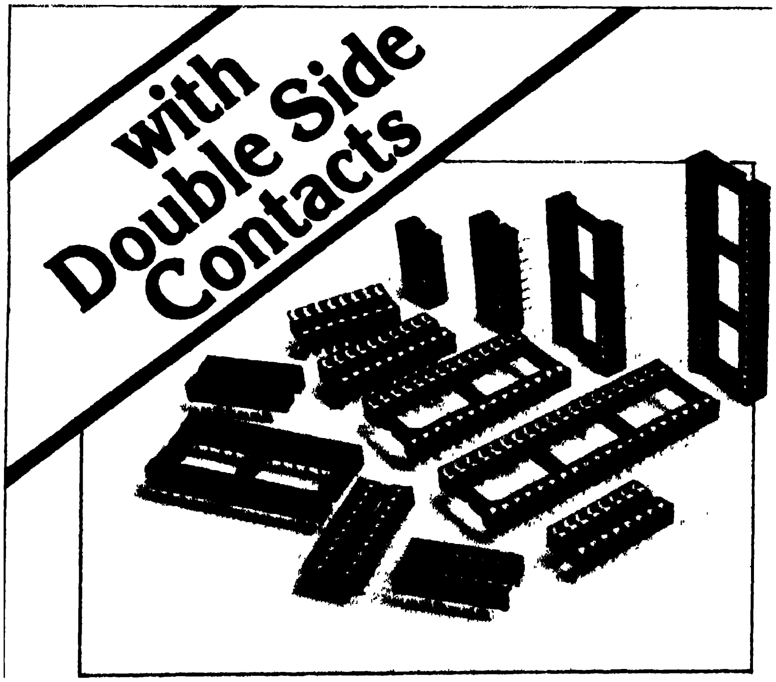

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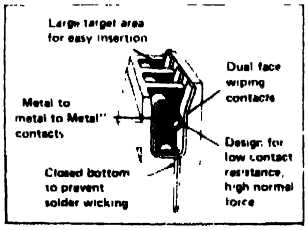
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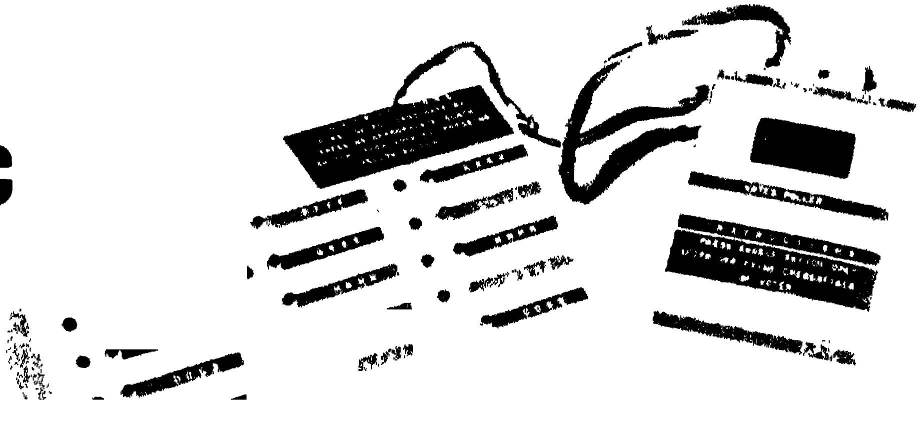

Part II

Ashok Baijal

Last month we discussed the modules of the main board. This month we shall see the working of the other boards.

The memory board

The circuit uses 16×4-bit RAMs for recording the results. The ICs can register 4-bit words at 16 different locations. A number of these ICs can be cascaded as shown to give any desired maximum vote count.

IC14 registers the least significant digit whereas IC20 registers the most significant digit. The memory is addressed through pins 1,13,14 and 15. On receiving a low pulse at pin 3, the memory registers the data placed at pins 4,6,10 and 12 which, after an inversion, are available at pins 5,7,9 and 11.

IC16 is a counter that can be pre-set. If parallel load pin 11 is held low, data at pins 1,9,10 and 15 is loaded into the counters and is made available at pins 2,6,7 and 3.

The counter is incremented on receipt of clock pulses at pin 5. To facilitate cascading of the counters, a terminal count output is available at pin 12 which serves as a clock for the next counter. The BCD count is available at pins 3,2,6 and 7.

IC15, a 7400 quad 2-input NAND gate IC, is used for clearing the memories at power switch 'on' and to invert the counter output before it is stored in the memory. Since the memory outputs are inverted by feeding inverted data, the right output is obtained.

At power switch 'on', monostable IC13 is activated, producing a high-going pulse at its pin 3. (Refer Fig. 3 of Part I). This is inverted by transistor T1 and fed to pins 2, 5, 10 and 13 of ICs 15, 18 and 21. Since at least one input of each of these NAND gates is forced low, their corresponding outputs at pins 3, 6, 8 and 11 of ICs 15, 18 and 21 go to logic 1. This places a '1111' at the memory inputs of ICs 14, 17 and 20.

Further, pin 1 of IC12 (on main board) is held low during this period. IC12 is a quad 2-input data selector which selects data between the input available at pins 2, 5, 11 and 14 and the input available at pins 3, 6, 10 and 13 according to the control input at its pin 1. During the period that pin 1 is held low, the input at pins 2, 5, 11 and 14 (i.e. the output of counter IC8) is available at its output pins 9, 12, 7 and 4. This causes all the memory locations to be strobed in quick succession.

Since the pulse generators are also triggered during 'power up', a 'write enable' pulse is provided at pin 3. This clears the entire contents of the memory and a '0000' is written at each address. The 'memory clear' sequence is initiated automatically at power switch on.

Once the monostable IC13 has timed out, its pin 3 goes low thereby switching off transistor T1. Now since pin 1 of IC12 goes high, the output of IC11 is placed on the memory address lines. The machine is now ready for use.

The monitor/display board

The monitor board is used by the polling booth incharge for controlling the voting machine. It also indicates the total votes polled during a particular time period.

Whenever the 'vote' switch is pressed, a down-going pulse is available at pin 12 of the control flip-flop. This is used for counting the total votes polled during a day. Ripple counter 7490 ICs are used. The clock pulse from the control flip-flop is fed to pin 14 of IC23. The count is available at pins 12,9,8 and 11. The output at pin 11 is fed to the clock input of the next counter. With four counters, a total vote-count of '9999' is possible. More can be cascaded if desired.

In order to utilise the same displays for indicating the results and the total votes polled, IC 74157s are used. 7446 ICs decode the BCD count for the 7-segment displays.

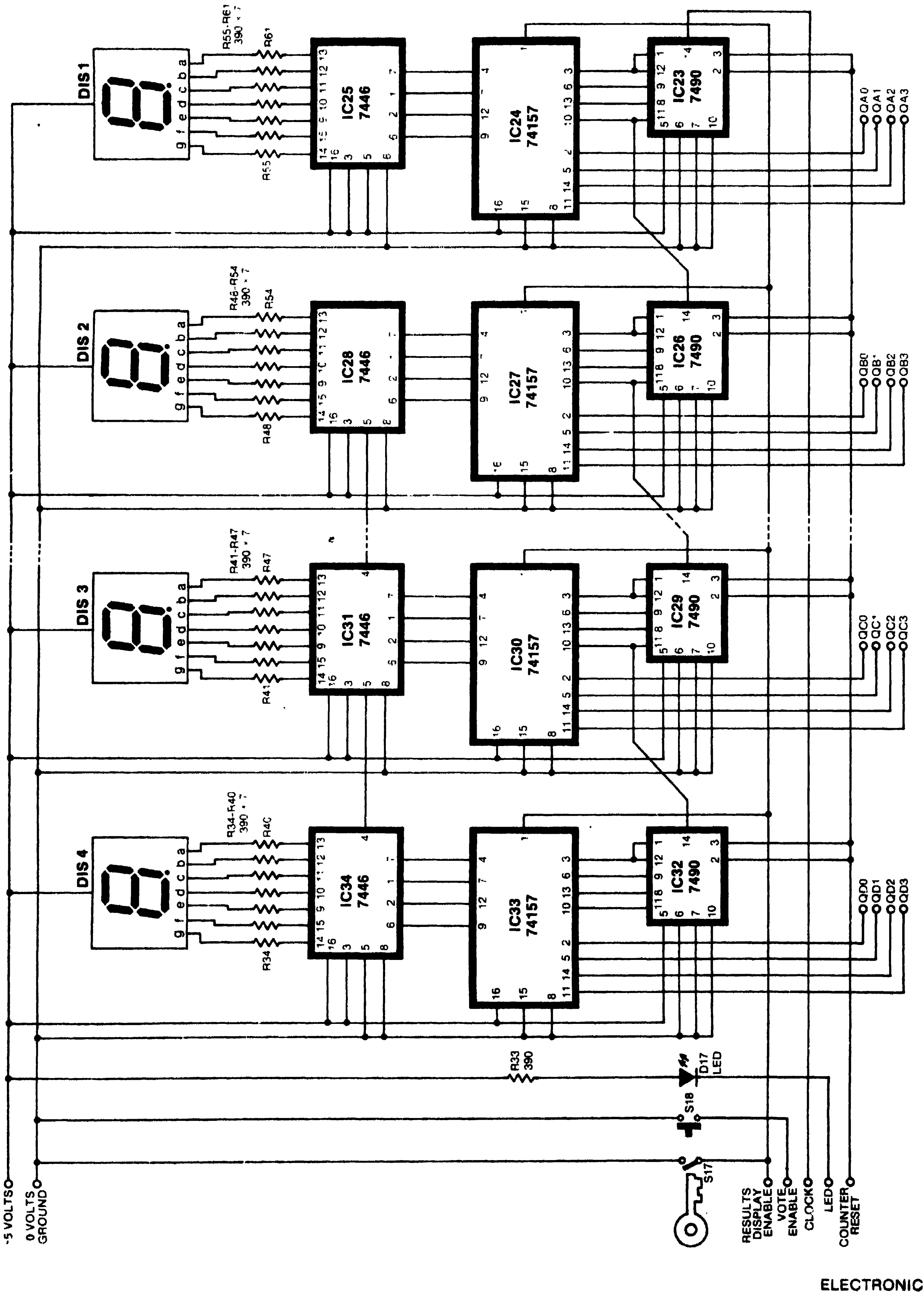

Fig. 8: Circuit diagram for Monitor board.

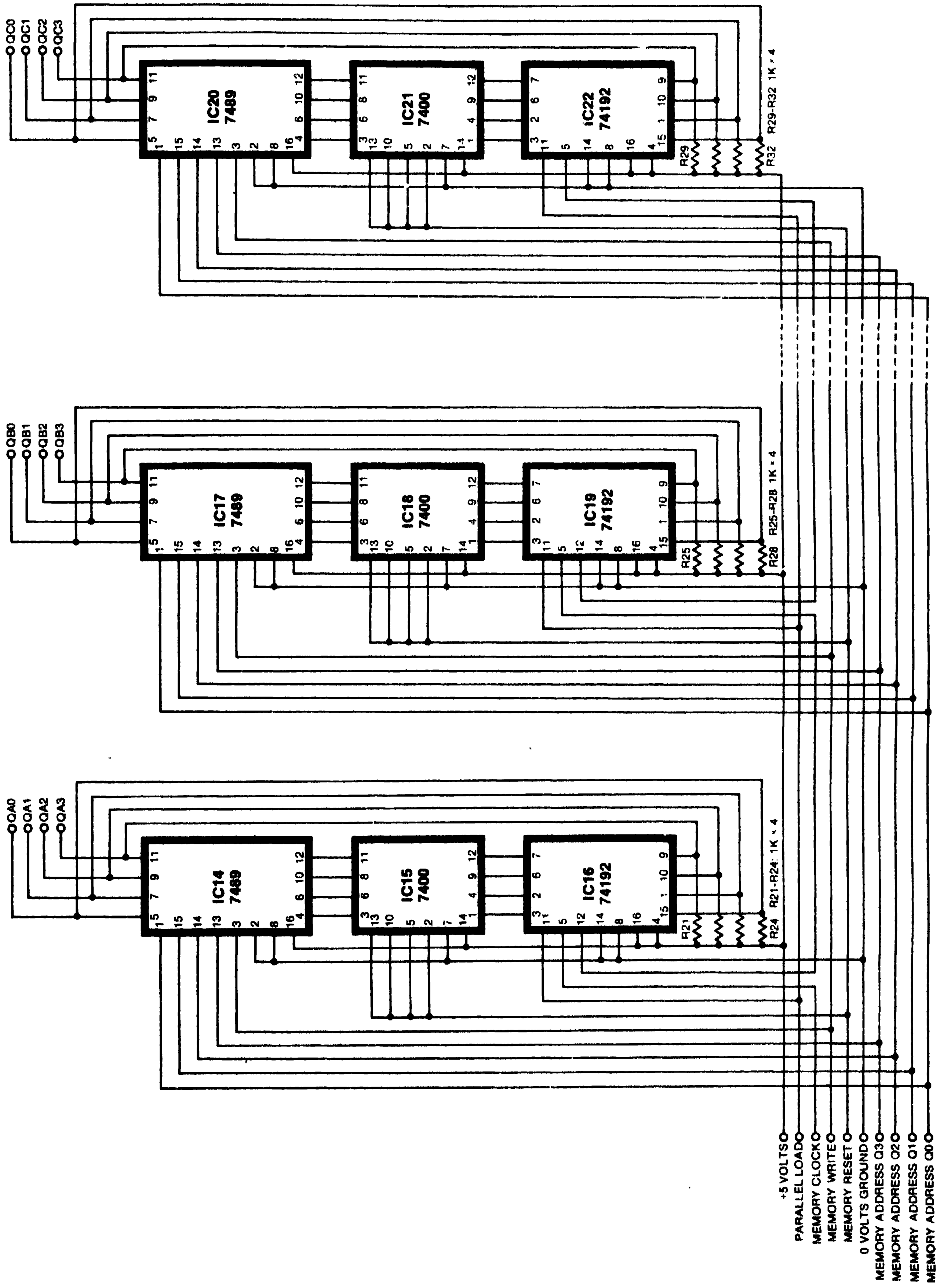

Fig. 9: Circuit diagram for memory board.

PARTS LIST
(For Memory Board)

Semiconductors:

IC16, IC19, IC22	74192 presettable BCD up/down counter
IC15, IC18, IC21	7400 quad 2-input NAND gate
IC14, IC17, IC20	7489 64-bit random access memory

Resistors (all ¼watt, ±5%, carbon)

R21-R32	1 kilohm

Miscellaneous:

IC sockets, PCB, ribbon cable, PCB connectors, suitable enclosure/spacers, nuts, bolts and washers etc

PARTS LIST
(For Monitor Board)

Semiconductors:

IC23, IC26, IC29 IC32	7490 BCD ripple counter
IC24, IC27, IC30, IC33	74157 quad 2-input data selector
IC25, IC28, IC31, IC34	7446 BCD to 7-segment decoder driver
DIS1-DIS4	LND507 common cathode display

Resistors (all ¼watt, ±5%, carbon)

R34-R61	390-ohm

Miscellaneous:

S17	Auto ignition key switch
S18	Push-to-on switch
	PCB, IC sockets, ribbon cable, PCB connectors, spacers, nuts, bolts, washers, suitable enclosure etc

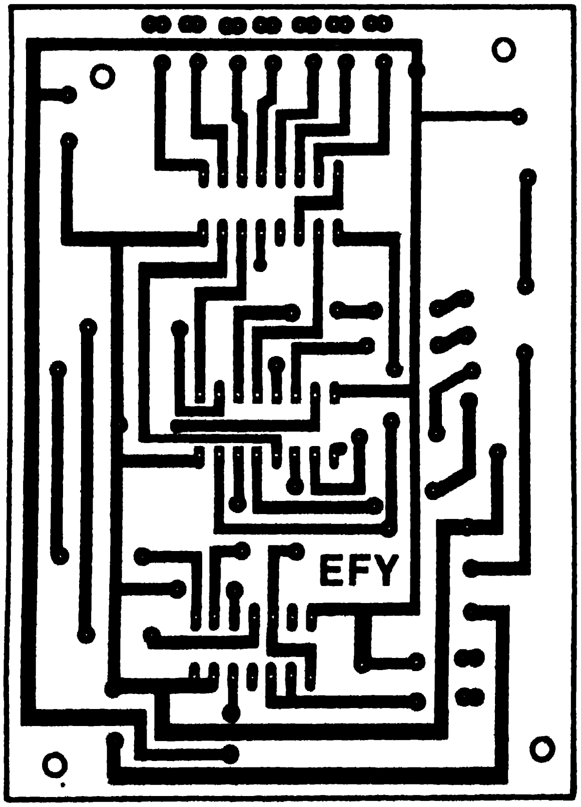

Fig. 10: Actual size PCB layout of monitor board for single display operation. To extend the display digit to more than one join two or three boards serially as per the number of digits required.

Power supply

The unit requires a current of about 950 mA. The current can be reduced considerably by using the 'LS' version of the TTL ICs instead of the normal TTL ICs used in the prototype.

Since the current consumption is high, it is not advisable to run the machine on battery power alone. However, to ensure that the memories are not wiped out due to power failure, a battery back-up is essential. The circuit of a suggested power supply is shown in Fig. 14.

Transformer X1 steps down the mains voltage to 12 volts which is rectified by diodes D18 and D19. IC35, a variable voltage regulator IC, is used for obtaining a 9 volt-regulated output. The output voltage is adjusted by potentiometer R62. Similarly, the battery output is regulated by IC37 to provide an 8 volts output.

As long as the mains supply is available, diode D25 remains reverse biased and no current flows from the battery. However, if the mains fail, D25 is no longer reverse biased and current will flow from the battery.

IC36 finally steps down the voltage to 5 volts — the voltage suitable for operating the TTL ICs.

Operating the machine

At power switch on, as we have seen earlier, the machine automatically clears the memories and the 'total votes polled

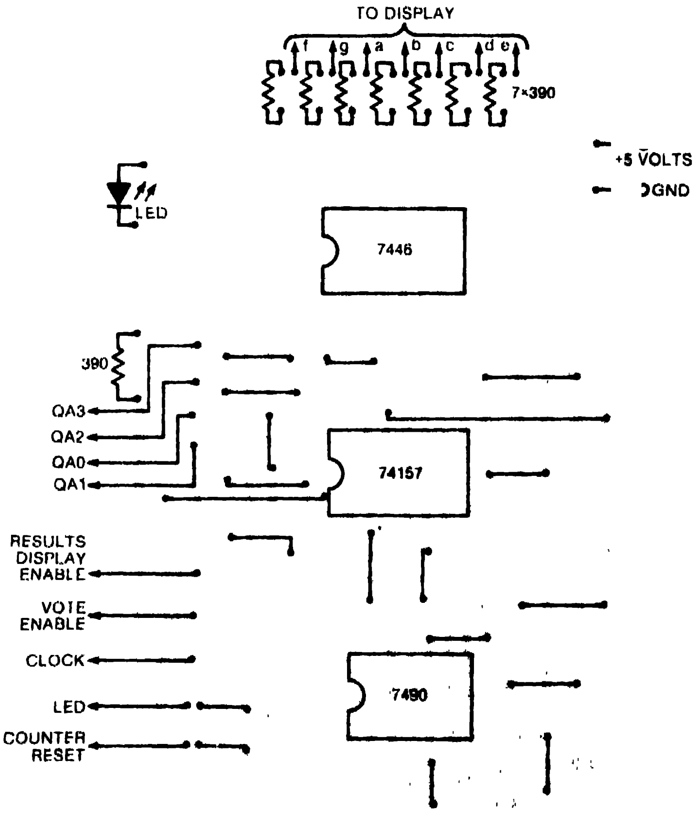

Fig. 11: Component layout for PCB.

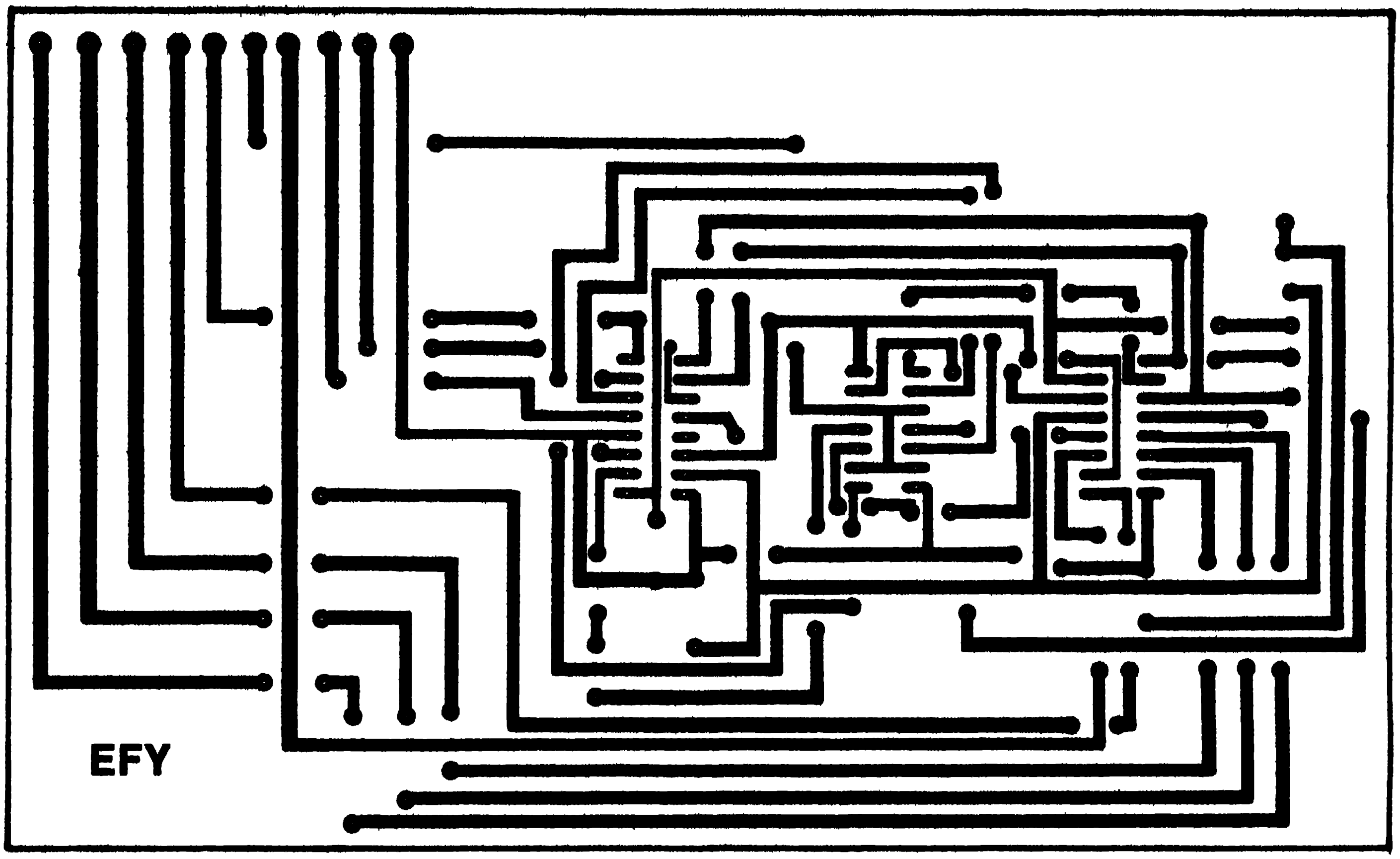

Fig. 12: Actual size PCB layout of memory board for single display monitoring. To extend the display digit to two or three join two or three such boards serially

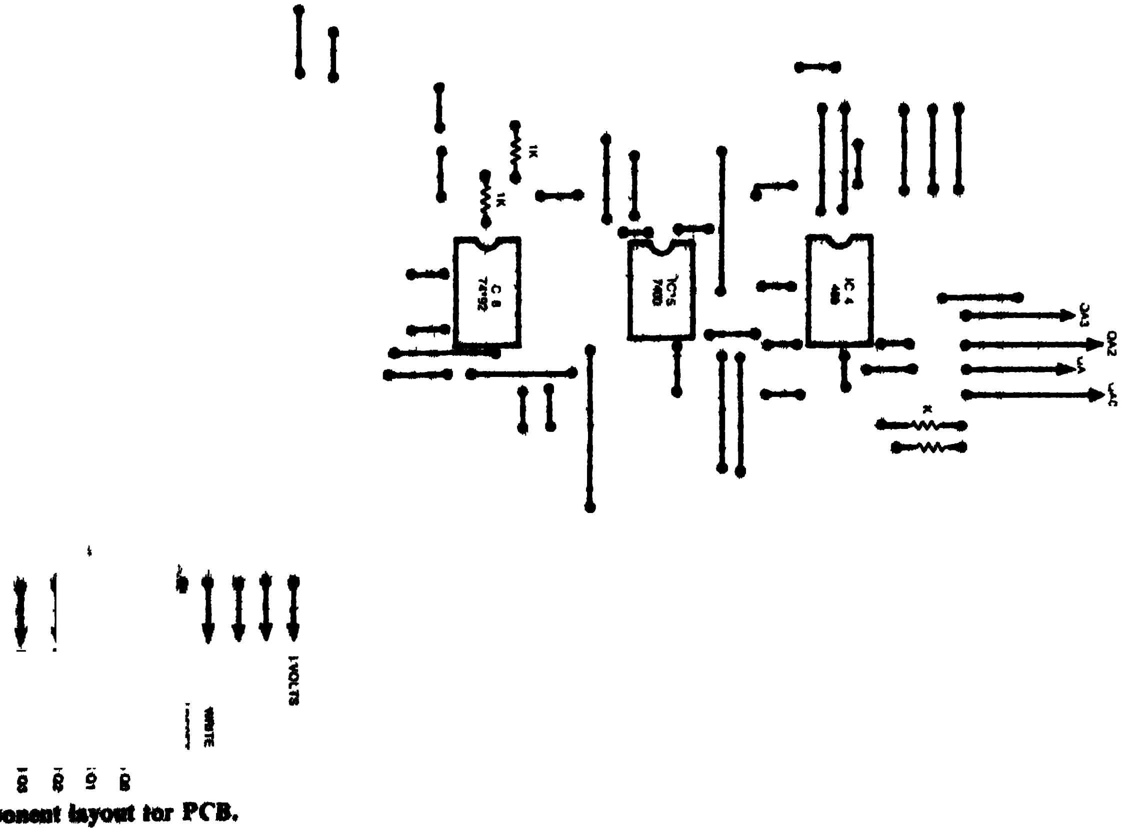

Fig. 13: Component layout for PCB.

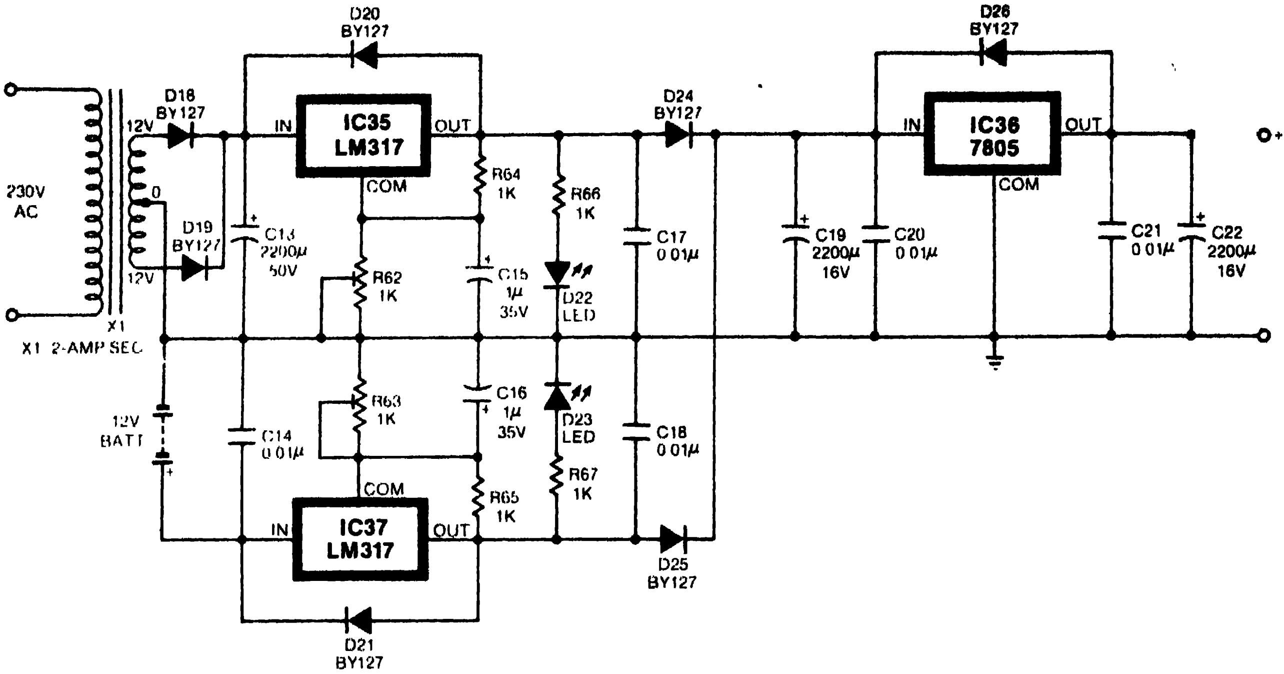

Fig. 14: Circuit diagram for power supply.

PARTS LIST

(For Power Supply)

Semiconductors:	
IC35, IC37	LM317K T, 3-terminal adjustable regulator
IC36	LM7805, 5-volt voltage regulator
D18-D21, D24, D25, D26	BY127, 1-amp rectifier diode
D22, D23	5mm light emitting diode
Resistors (all ¼-watt, ±5% carbon)	
R64-R67	1-kilohm
R62, R63	1-kilohm, vertical preset
Capacitors:	
C13	2200µF, 50V electrolytic
C14, C17, C18, C20, C21	0.01µF ceramic disc
C15, C16	1µF, 35V tantalum
C19, C22	2200µF, 16V electrolytic
Miscellaneous:	
X1	12V-0-12V, 2-amp secondary transformer
	Heatsink for voltage regulator, LED holders, mains cord, battery connectors, suitable enclosure, screws and nuts, bolts, spacers etc

counters'. The machine has to be enabled by the polling booth incharge before the first vote can be cast.

After verifying the credentials of the voter, the booth incharge presses 'enable' switch S18. Pin 8 of IC2 will go low. This will 'enable' the parallel load inputs of the memory counter ICs. Pin 6 of IC2 will go high, thereby enabling IC10. The keyboard now becomes operative.

The voter chooses his candidate by pressing the appropriate switch. The corresponding binary word is latched in IC11. This is used for addressing the memories. Since the parallel load inputs of the memory counters are enabled during the period, the memory contents get loaded into the counters.

On pressing the vote switch. pin 8 of IC2 goes high. Parallel load is disabled. Further, a down-going pulse is received at pins 3 and 4 of IC4 which produces a low-going pulse at its pin 1. The rising edge of this pulse serves as a clock for the memory counters. The pre-loaded data is therefore increased by one.

Thereafter, the second pulse generator is activated which produces a low-going pulse at pin 4 of IC5. This serves as a 'write enable' pulse for the memories. The contents of the memory are therefore replaced by the counter output. This in effect means increasing the previous data in the memory by one.

As such, the voter's desire is recorded at the location corresponding to his choice. The pulse available at pin 13 of IC5 enables an astable which generates an audio tone. This serves as an annunciator for indicating that the vote has been registered.

The third pulse generator is activated next. This produces a 'latch enable' pulse. Further, since after pressing the 'vote' switch, pin 6 of IC2 goes low, the outputs of IC10 are held high. The latch registers a '0000' on receipt of the 'latch enable' pulse. This is essential to maintain secrecy of the voter.

At the end of the day, the 'results enable' switch is activated. Pin 6 of IC2 is forced high which enables the keyboard. Further, the contents of the memory are diverted to the decoder/displays by ICs 24, 27, 30 and 33. As such, the displays will indicate the results of the candidate corresponding to the key pressed on the keyboard.

Further, if any person tries to cast vote to two persons simultaneously an invalid vote will be registered. This happens because, if any key is held pressed after the 'vote switch' has been pressed, the latch resets and addresses '0000' location of the memory, thereby passing no benefit to the candidate.

(Concluded)

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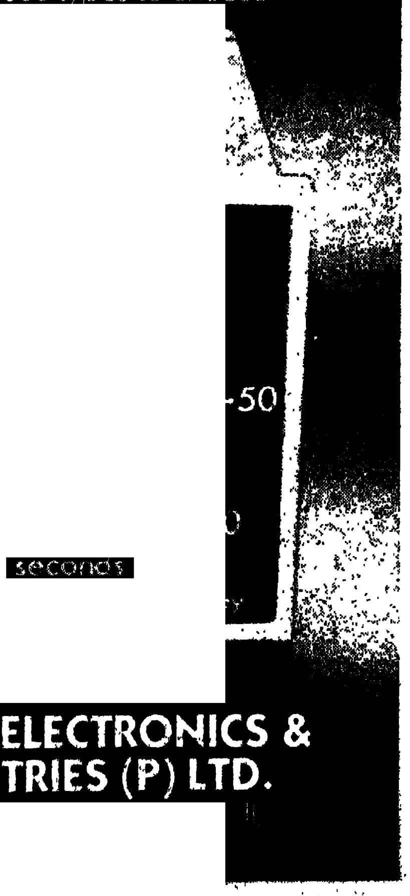

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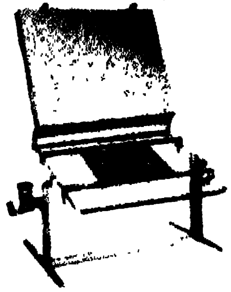

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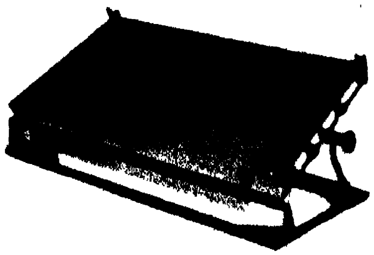

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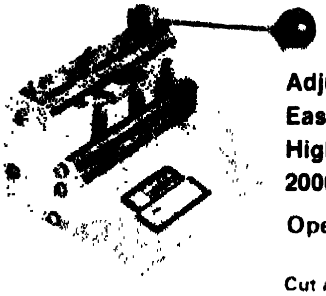

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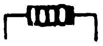
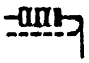
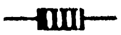
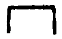
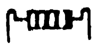
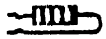
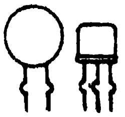
Cut and Bend	
Produce vertical mounting by bending over long leg	
cut to length	
Jumper link	
Stress relief	
Vertical Stand off	
Transistor / Capacitor Spread, Cut & form	

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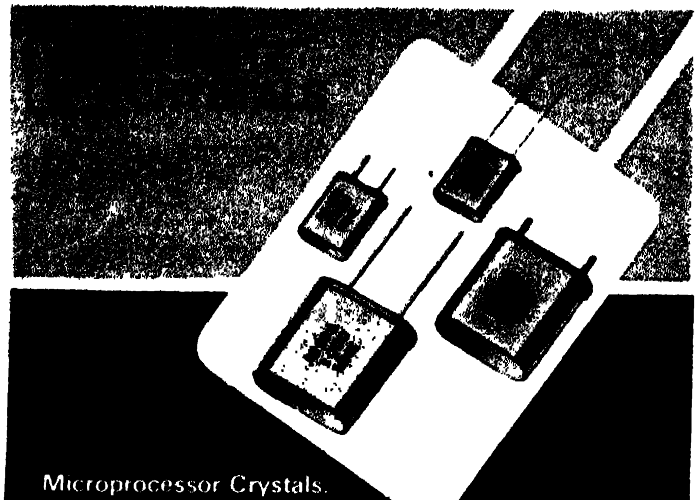

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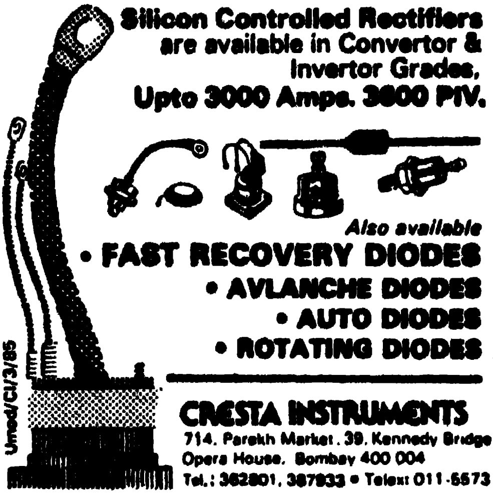

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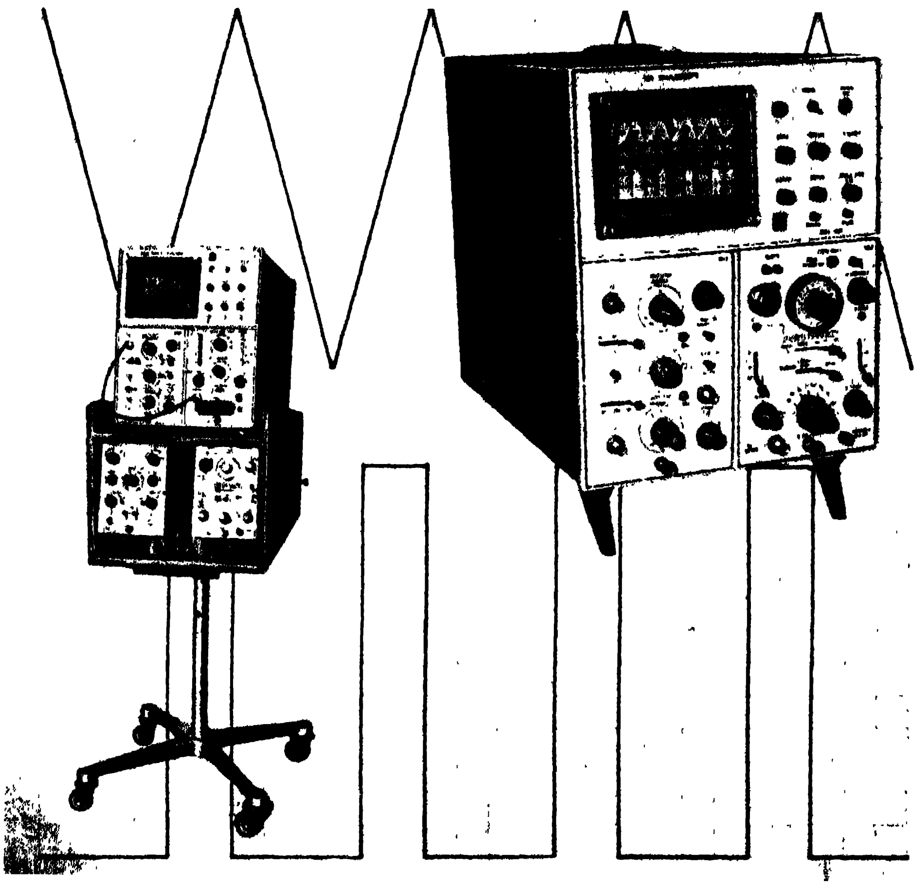

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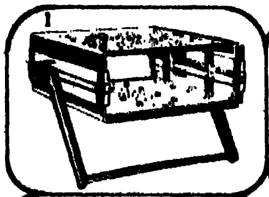

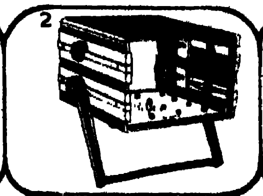

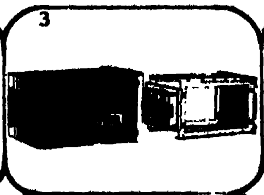

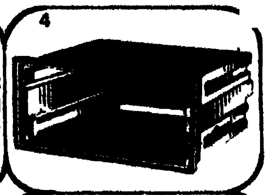

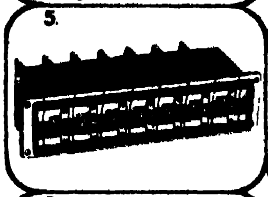

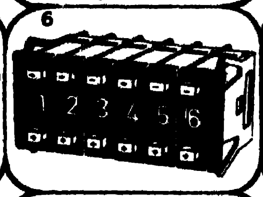

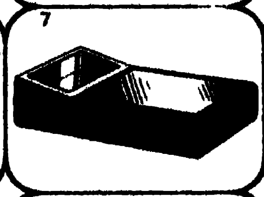

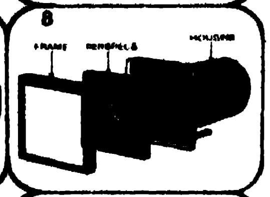

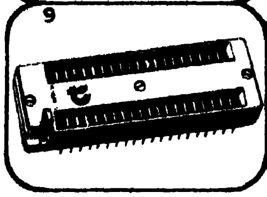

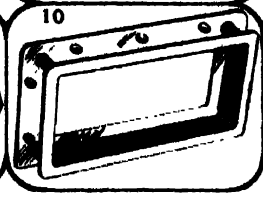

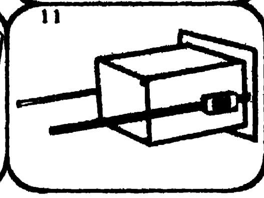

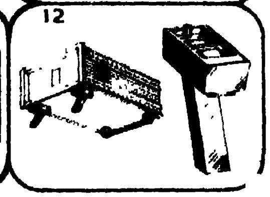

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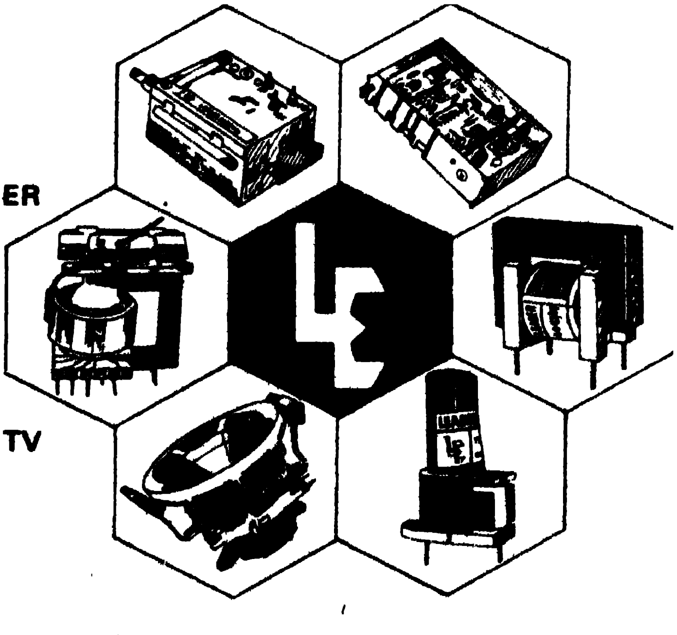

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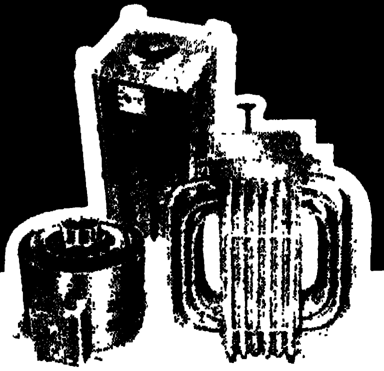

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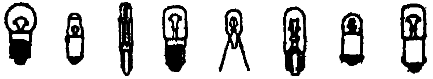

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Here is a simple but versatile continuity tester for checking resistors, capacitors, wiring connections, transformer windings and electric bulbs etc. It not only tests their condition but also indicates the approximate range of component value.

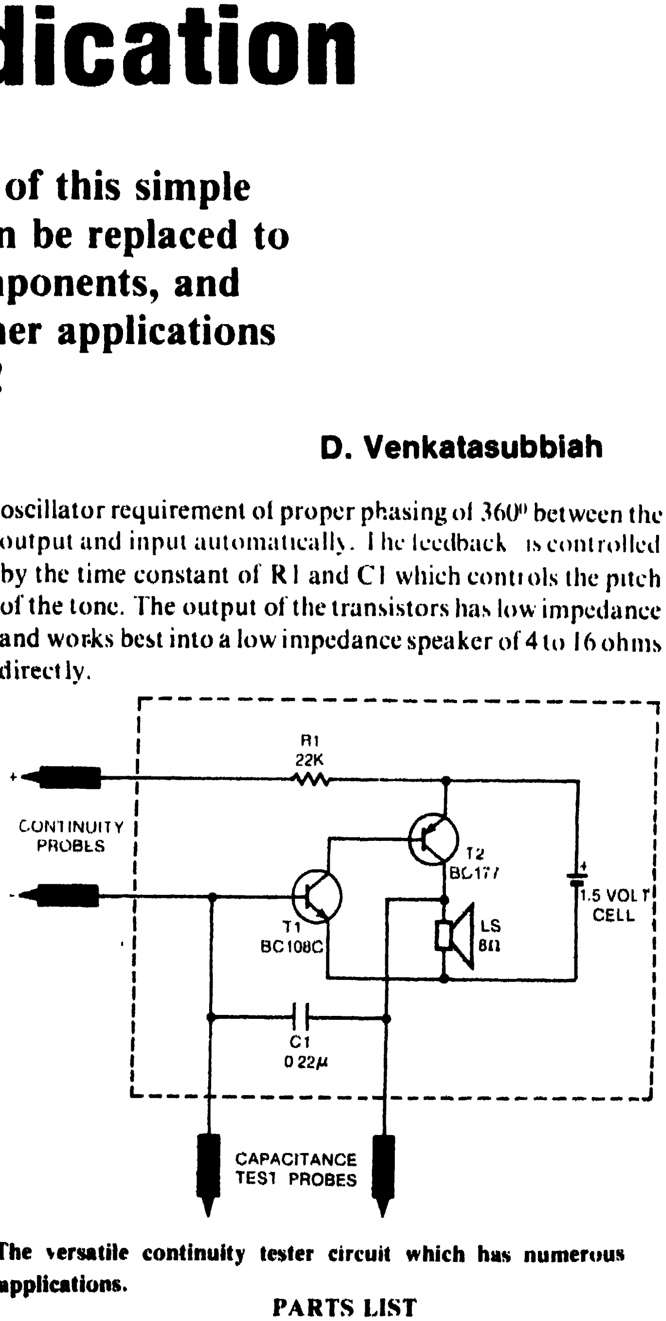
Moreover, it helps in testing semiconductor devices such as diodes and general-purpose transistors. Interestingly, it can identify their leads if their marking of actual pin code on the casing or on the package has been erased. It can even indicate whether it is a pnp or a npn transistor. Thus, an unknown transistor can be easily identified, both for its type and leads configuration, in many cases successfully.

In addition, the tester can probe the condition and quality of loudspeakers and dry cells too. It may be noted that batteries are actually checked here under load and thus give a realistic picture. The loudspeaker is similarly tested under true dynamic conditions, and so even its audio frequency characteristics can be monitored. Testing a loudspeaker with a multimeter or with any simple meter is not possible But this tester does it!

The tester can also be used as a musical toy, water level indicator, rain alarm, soil moisture tester, body resistance tester and so on. For all this, it requires just five standard components.

Simplicity of the circuit, single 1.5V dry cell operation, and an audible indication are the novel and useful features of this arrangement. Anyone can afford this fail-proof tester which can be fitted in a plastic box of the size of a pocket transistor radio. The speaker alone limits the size of tester assembly.

In the circuit, T1 and T2 form an audio oscillator with C1 in the feedback loop. The two transistor stages provide the oscillator requirement of proper phasing of 360° between the output and input automatically. The feedback is controlled by the time constant of R1 and C1 which controls the pitch of the tone. The output of the transistors has low impedance and works best into a low impedance speaker of 4 to 16 ohms directly.



The versatile continuity tester circuit which has numerous applications.

PARTS LIST

T1	BC108C npn silicon transistor
T2	BC177 pnp silicon transistor
C1	0.22µF polyester
R1	22-kilohm, ¼watt, ±5% carbon
BATT.	1.5-volt, penlight cell
LS	8-ohm loudspeaker
	Testing probes, general-purpose board, battery holders, connecting wires etc.

A single 1.5V cell gives enough volume for continuity tests. If one needs more volume, two or even three cells may be connected in series.

The circuit's operation is virtually fool-proof and almost any audio transistor will function in the circuit. The values of R1 and C1 need not be precise. Even T1 and T2 can be interchanged by reversing the battery polarity.

It is not necessary to use any extra switch for switching the tester on and off. When the tester is not in use, the battery faces only the collector to emitter resistances of transistors in non-conduction state of no bias drive. These resistances are high enough to limit the leakage of battery in idle condition. However, if the tester is idle for too long a period, the battery may be removed from the tester circuit to avoid leakage.

As continuity and resistance tester

When the continuity probes are open, the circuit is ineffective and no current flows. On connecting the unit under test across the continuity probes, if there is proper continuity through the unit under test, the sound is heard.

It is possible to test the continuity of electric bulbs, transformer windings, chokes, inductors, electric heaters, stove elements, wires, cables, power cords, hot plates, ovens, switches, TV antennae and printed patterns in circuit boards. However, while testing continuity, the capacitance test probes should be left open.

This continuity tester uses only 1.5V supply and hence is quite safe for testing many sensitive components too. With many multimeters, we are unable to check the continuity of 1M or higher resistors as the needle refuses to move. But this tester emits sound even in that range.

Resistors of near-zero to over 1 megohm can be tested by connecting them across the continuity probes, while keeping the capacitance test probes open. For higher resistances, the tone frequency becomes lower. For very high resistances, instead of a continuous sound only ticking sound is heard. Thus it gives a fairly good indication of the value of resistance under test, by comparison.

As capacitance tester

For testing capacitors, the continuity probes should touch each other and the capacitor under test connected across the capacitance test probes. Capacitors in the range of 0.22μF to 250μF can be tested easily and directly.

Here also, with high value capacitors, ticking will be heard and the ticking rate becomes slower with higher value capacitors. For testing lower value capacitors, say down to 0.01μF, C1 should be disconnected and R1 should be increased to about 150 k. The electrolytic capacitors should be connected with proper polarity, as indicated in the capacitance test probes.

The circuit is safe even while testing a short-circuited capacitor, in which condition it gives no sound. Thus it indicates the short without damaging itself.

As diode tester

The diode under test should be connected across the continuity probes, keeping the capacitor test probes open. This tester monitors the diode's action and gives an indication of reverse resistance too.

If anode of the diode is connected to positive marked continuity probe and cathode of the diode is connected to negative marked continuity probe, a good diode allows the oscillator to work and so a continuous sound is heard. If the diode's connections are reversed, the reverse resistance comes into the circuit. For an ideal diode no sound should be heard. However, most diodes have limited (very high) reverse resistance which is indicated by a ticking sound. The ticking rate gives the quality of reverse characteristics.

If the diode is open, it gives no sound in both directions. If the diode is shorted inside, it gives the same continuous tone in both directions.

Even if the correct diode leads are not known, this tester can be used to identify the anode and cathode leads correctly. Normally, a dot on the diode's body indicates the cathode terminal. If this dot is not visible, this tester helps to identify the leads.

Because of 1.5V operation, this tester is safe for testing sensitive signal diodes as well. Some multimeters use 3 V, or even 9 V, and are therefore unsafe for testing voltage sensitive components.

As transistor tester

If it is a general-purpose transistor, you can test its leads as well as performance. Short-circuit the continuity probes and make sure of sound from the loudspeaker.

For testing a pnp transistor, replace T2 with it and try it in T2's socket randomly in all of the six possible ways. Change the positions of leads until the circuit oscillates and produces sound. Leads of the transistor in this position obviously correspond to that of the good transistor T2 it replaced. If oscillator refuses to work in any of the positions, the transistor is faulty.

Similarly, an npn transistor can be tested in the socket of T1. If even the type of transistor is not known, it may be tested one by one in sockets of T1 and T2.

Some transistors like AC126 and AC128 give feeble sound when emitter and collector leads are interchanged. This also helps in identifying transistor terminals.

Base-to-emitter and base-to-collector junctions can be tested for diode action by connecting them across the continuity probes. For a npn transistor connect the base to the positive marked continuity probe and connect the emitter and collector one by one to the negative marked probe. Good junctions permit the oscillator to work and sound is heard. If the connections are reversed it should give no sound or only ticking should be heard. Similarly, pnp transistor's base-to-emitter and base-to-collector junctions can be checked. □

As loudspeaker tester

Testing a loudspeaker is tricky. By merely testing continuity of speaker's coil full information is not obtained about the working condition of the loudspeaker. Doubt persists about the paper cone condition and the state of fixture of the coil and the cone. The best course is to test loudspeaker in its actual dynamic state of working for true evaluation. For testing any low impedance loudspeaker, all that is required is to replace the actual loudspeaker in the circuit with the loudspeaker under test and observe its performance. Remember, the continuity probes must be shorted for testing. Put a variable potentiometer either across continuity terminals or in place of R1 and observe the change in sound by varying the potentiometer. Thus, the audio characteristics of a loudspeaker or transistor used can be studied.

Except for the loudspeaker, rest of the circuit can be fitted into even a matchbox. So this simple gadget can help in on-the-spot evaluation of loudspeakers while buying them in the market. This tester is ideal to check the low-cost loudspeakers, no two pieces of which behave identically. For checking quality products this tester may not serve well, except for giving information whether the unit is functional or defective.

As musical toy

Replacing resistor R1 by a potentiometer or by a bank of resistors and switching them into circuit sequentially, changes the tester into a musical toy organ. Choose resistors in the range of 10k |to 100k in steps of about 10k for good results. Remember, it needs only single penlight cell, though two cells may be used for more sound.

As water level indicator/rain alarm/soil moisture tester

The continuity probes can be used for water level indication too. When both probes are immersed in water, the tester emits sound. Arrange the probes such that one of them is near bottom of water tank and the other near its top, where the level is to be indicated. Thus it can be used to switch off the water booster pump when water tank is full, on hearing the sound.

For rain alarm, the probes may be left outside in the open, fitted in a container for collecting rain water, with some spacing in between them. When it rains, the rain water or rain drops bridge the circuit to produce an audio alarm.

For soil moisture tester, the probes may be made of two suitable lengths of brass rods. The circuit can be used to test the water content of pot plants. An advantage of this tester is that the probes enable the soil beneath the surface to be checked instead of just relying on its surface condition.

By holding the two probes in both hands, one can also compare the body resistance! The tester produces a ticking sound. If the probes are held more firmly, the ticking rate becomes faster, indicating a fall in contact resistance. Thus, it shows that the contact resistance at the skin constitutes a major portion of body resistance. If the hands are moistened, the ticking rate increases further.

As battery checker

A multimeter tests the battery voltage but not the quality of the battery. The mere testing of open-circuit voltage is not at all an adequate test. The test should be done on load, i.e., while testing a battery voltage with multimeter. Shunt the battery with a load and then test its voltage.

Instead, this simple tester may be used for the same purpose. For testing the battery (or dry cell), connect it in place of the circuit's battery terminals with proper polarity. Of course, while testing single cells if the battery terminals are reversed, it causes no harm, except that the tester refuses to work. The circuit components are quite safe even with reversal of a single cell's voltage.

Quality of battery can be judged from the sound produced. A fresh or good battery gives more sound. An old and used battery produces faint sound. The 'dead' battery produces no sound at all.

You can test batteries or dry cells from 1.5 V to 9 V. Even the button cell used in your watch can be faithfully tested. This also implies that this tester can be powered by even a button cell to make it compact. Short the continuity probes and leave the capacitance test probes open while testing batteries.

□

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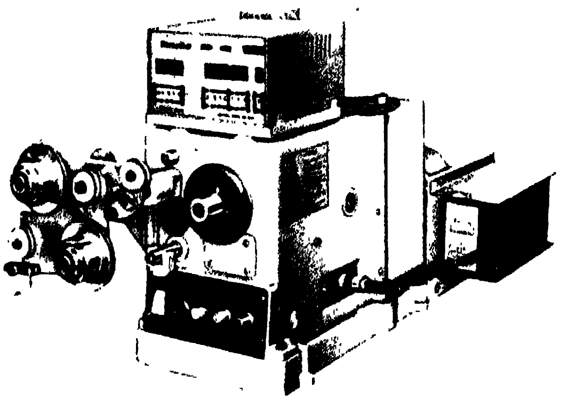

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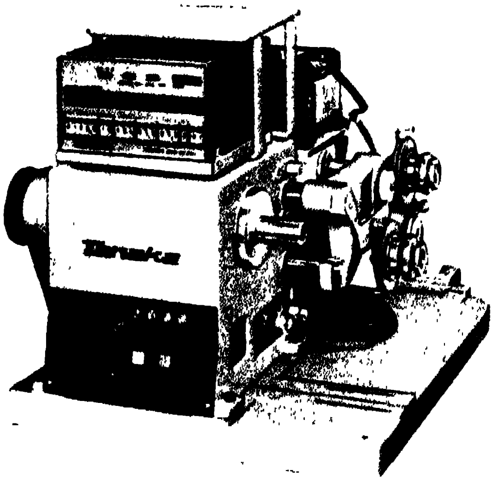

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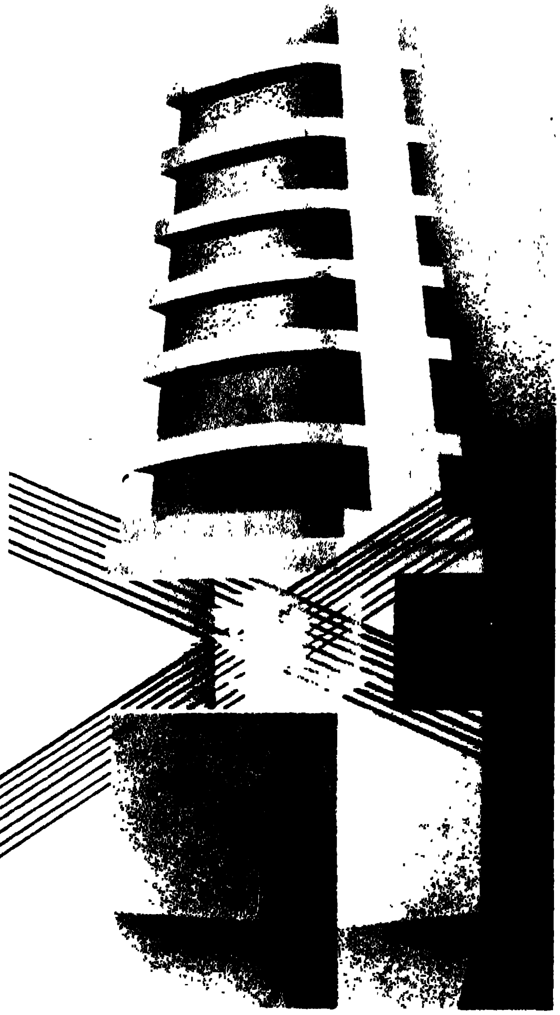

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Inexpensive Electronic Switch for Audio Signal

Anyone who has assembled a preamplifier will appreciate the fact that the complexity associated with switching audio signal is proportional to sophistication of the playback system. The audio signal must be sent, for example, to monitor, tone correction stages, special effects, and so on. In other words, there are lots of cables which either have to be moved from one place to another or some switches are necessary.

Frequently, mechanical switches are used for this, but these switches are available only in a few standard forms and are generally of poor quality. Moreover, mechanical switches are found hopelessly inadequate, especially, for remote control. Imagine the convenience of changing from record player to tape recorder, without leaving the comfort of your chair!

In case you want to have your audio equipment with touch switches or membrane keys you have to go for electronic switches. With electronic switches the designer is only bound by his budget and imagination. This circuit is meant to relieve you from the limitation of budget so that you can stretch your imagination to make a beautiful audio equipment.

There are various ways of switching audio signals (FET, OTA, CMOS switch etc). The circuit described here is a less known one.

Heart of the circuit are LEDs. When an LED is forward biased with a biasing current of about 20 mA it offers a negligible AC resistance. But it offers about one megohm resistance when unbiased. When a biasing current of about 20 mA passes through an LED its volt-amp curve is fairly linear. Therefore, for an audio signal of small amplitude (about 100 mV) the harmonic distortion induced will be well under the 0.3% limit of hi-fi.

Transistors T1 and T2 (similarly T1' and T2') are connected in regenerative mode. When S1 (S2) is pressed momentarily, the current gets T1 and T2 (also T1' and T2') into conduction. A DC of about 20 mA flows through R1, D1 (R1', D1') and R3. Thus AC resistance of path C1-D1-C2 (C1'-D1'-C2) comes down to a few ohms from about a megohm and the audio signal goes from channel-1 (channel-2) to output.

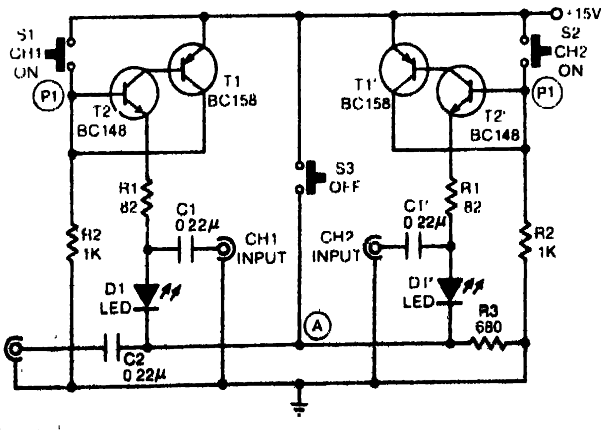
On pressing switch S2' (S1) momentarily T1' and T2' (T1, T2) start conducting. Owing to this, current potential of point A rises to such a level that T1 and T2 stop conducting. So audio signal from channel-2 (channel-1) goes to output.

Capacitors C1, C1', C2 eliminate DC from appearing at input and output. Resistors R2, R2' limit the noise current to ensure stable operation. The LED also gives a visual indication of the 'on' channel. Switch S3 is provided to switch off both the channels.

If you get distortion while using aux. output of a tape recorder as source which has signal amplitude higher than 100 mV, connect a 100k resistors in series with C1 and C1' in the input. Also check for 12.4V potential difference across R3 to ensure that a proper biasing current is passing through the diode.

If more than two switches are necessary the circuit from T1 to D1 must be repeated. For remote control, a 15V signal at points marked A, P1 and P1' has to be applied. This will cause the same effect as pressing switches S1, S2 and S3.

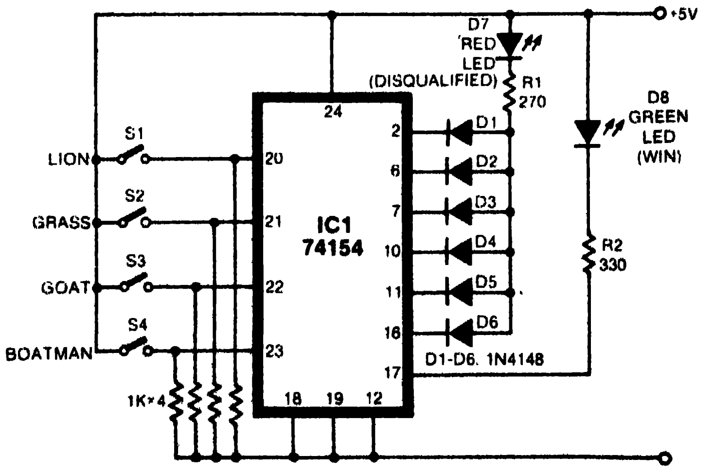
SOUMYANATH CHATTERJEE



Boatman's Puzzle Game Using Single IC

This circuit is a logic implementation of the boatman's puzzle. Although various circuits are available, the unique feature of the circuit is that it uses only one IC. As a result, this circuit is very simple and compact.

The boatman has to take the lion, the goat and grass from left bank of a river to its right bank. At the start of the game all four switches must be open.



TRUTH TABLE

LION	GRASS	GOAT	BOAT-MAN	Y
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

A '0' indicates leftside, whereas '1' indicates right side. Also Y = 1 means that the condition is not allowed.

Now the conditions giving Y = 1 are ORed using the diodes D1 to D6 and then light up a red LED. The green LED indicates that the game is over.

Since the circuit uses only one IC and a very few number of parts, it can be constructed on a veroboard or on any general-purpose IC board.

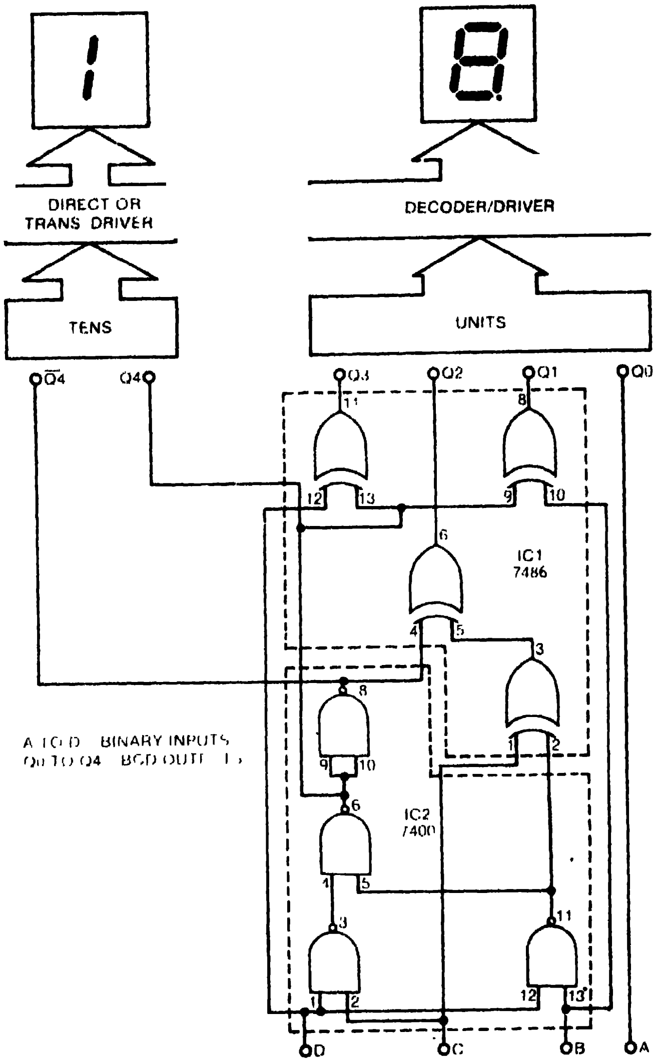
ASHOK K. MOGHI

4-bit Binary to BCD Converter

Four-bit binary to BCD conversion is often required in digital circuits to display the 4-bit binary data output from counters, latches, shift-registers etc. The circuit presented here performs a 4-bit conversion from binary to BCD using only two common digital ICs: a quad 2-input NAND and a quad 2-input EX-OR gate IC. This results in a compact circuit layout for this converter on the PCB. Four active high outputs, Q0 to Q3, are available for the BCD 'units' output and two complementary logic outputs Q4 and $\overline{Q4}$ are available for the 'tens' output.

TRUTH TABLE

	INPUT				OUTPUT					
	D	C	B	A	$\overline{Q4}$	Q4	Q3	Q2	Q1	Q0
0	0	0	0	0	1	0	0	0	0	0
1	0	0	0	1	1	0	0	0	0	1
2	0	0	1	0	1	0	0	0	1	0
3	0	0	1	1	1	0	0	0	1	1
4	0	1	0	0	1	0	0	1	0	0
5	0	1	0	1	1	0	0	1	0	1
6	0	1	1	0	1	0	0	1	1	0
7	0	1	1	1	1	0	0	1	1	1
8	1	0	0	0	1	0	1	0	0	0
9	1	0	0	1	1	0	1	0	0	1
10	1	0	1	0	0	1	0	0	0	0
11	1	0	1	1	0	1	0	0	0	1
12	1	1	0	0	0	1	0	0	1	0
13	1	1	0	1	0	1	0	0	1	1
14	1	1	1	0	0	1	0	1	0	0
15	1	1	1	1	0	1	0	1	0	1



The truth table for the conversion is also shown. For binary inputs A to D having values from '0' to '9', the active high output of the 'tens' (Q4) remains low, while the active high outputs' of the 'units' (Q0 to Q3) give a BCD output of '0' to '9' correspondingly. For binary inputs between '10' to '15', the active high output of the 'tens' remains high while the 'units' output gives a BCD output of '0' to '5' accordingly.

These active high outputs can be used for further logic operations or for driving displays. The 'units' 4-bit BCD output can be fed through a suitable BCD to 7-segment decoder/driver for driving 7-segment displays. The 'tens' active high output can be used to drive the 'tens' '1' display through a suitable transistor driver. If the display for the 'tens' is a common anode type with sink current less than about 14 mA, then the active low output of the 'tens' ($\overline{Q4}$) can be used to directly drive the display, saving further components.

S.K. BISWAS

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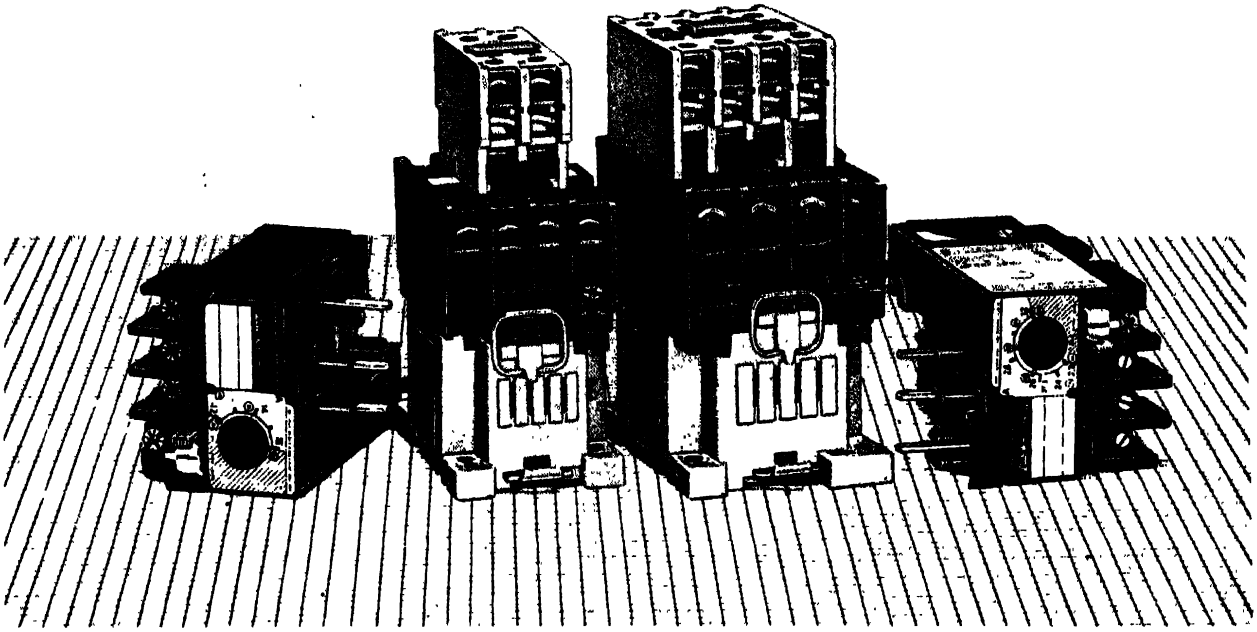

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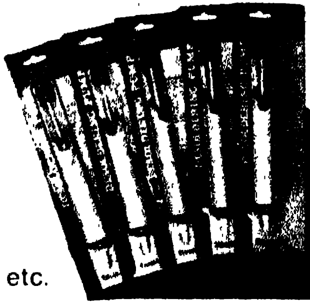

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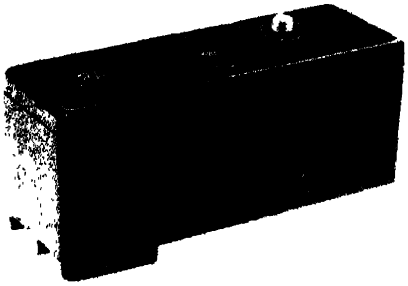
Product Profiles

STANDARD MICRO SWITCH

Raj Standard Micro Switches series are single pole snap acting having one normally open and one normally closed contacts. The fixed and moving contacts are of pure silver whereas the operating force is 425 gms(max). The operating mechanism is of beryllium copper trident spring, having exceptional repeat accuracy and a very long electrical and mechanical life. It has a wide application in industrial and electronic controls.



STANDARD MICRO SWITCH

Contact: Chawla Trading Company, 1651, Bhagirath Palace, Chandni Chowk, Delhi 110006.

QUICK-CONNECT TERMINAL BLOCKS

'IEC' Terminal Blocks are a completely new concept in terminal connectors. For fixing the cables, there is no need of soldering, screwing or using tags. A pushbutton clamping enables rapid connection or release. Just push and insert the cable and it gets fixed.

QUICK-CONNECT TERMINAL BLOCKS

Moulded in high grade, rigid glass filled polycarbonate moulding, these can withstand 500 volts and accept wires up to 4mm² cable size. Rated at 36 amps, each block has 4 ways.

Contact: Asia Electric Company, Katara Mansion, 132A, Annie Besant Road, Worli, Bombay 400018.

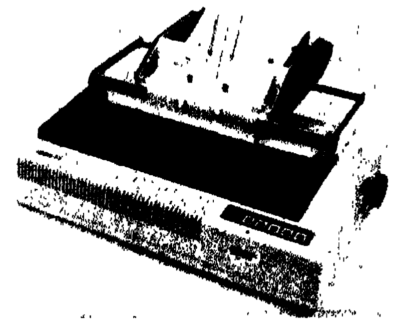
LIQUID LEVEL CONTROLLER

Russe Electronic Industries has recently developed new electronic Liquid Level Controller. The probe of the instrument is made of special steel/PVC material which is immune even to the most corrosive acids.

The level controller is especially designed to monitor levels of overhead tanks and has the ability to withstand the rough weather condition for waterworks departments, irrigation departments, PWD departments and others as well.

Contact: Industrial Marketing & Services, 42/1243, Nehru Nagar, Kurla (East), Bombay 400024.

The versatile Single Sheet Feeder is patented and based on well established principles for the modern computer printers, based on new patented Multimatic concept of Easifeed Cut Sheet Feeder always of the same design and bracket for attachment appropriately designed for every printer model.



SHEET FEEDER

Easifeed has no electronics and clips on straight to the printer. No power connections are required. It can handle all paper sizes up to A4. Paper can be replenished without stopping print run.

Contact: Brisk Electro Sales Pvt Ltd, 394-A, Lamington Chambers, 2nd Floor, Lamington Road, Bombay 400004.

WIRE DISPENSER TRAY

Dispenser Tray is the ideal unit for neatly organising pre-cut or cut and stripped wires to be used for assembly operations, wire harnesses, etc in the electrical and electronic industries. It contains fourteen slots to allow a variety of different types and lengths of wires to be inserted and dispensed from a single portable unit. Each slot can hold from 7 to 59 wires, depending on their outside diameters.

WIRE DISPENSER TRAY

The wires are held in the slots by use of special foam. Groups of wires are easily inserted by pushing them into the foam. The foam then allows only the wire or wires being pulled to come out of the slot, leaving the remainder intact, neatly organised, until ready for dispensing.

Two spools incorporated into the unit allow wires of varying lengths to be used without tangling. Long lengths of wire can be wrapped around the spools and will easily pull out without disturbing adjoining groups.

Contact: The Eraser Company, Inc., P.O. Box 4961/Oliva Drive, Syracuse, New York 13221.

MULTIPOINT RECORDER/LOGGER

Multipoint Recorder/Logger with the powerful math option provides a new level of on-board data manipulation capability by way of an easily used 'block' approach. An extensive set of mathematical and Boolean operators can be combined to define a channel based on a simple or complex algorithm. Twenty-four different block operators are available.

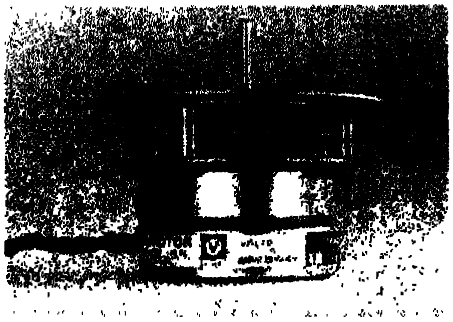
MULTIPOINT RECORDER/LOGGER

The RS232C communication interface is a convenient communication port that allows the user to select word length, parity and baud rate and also determine the reporting interval. With this new option, the MRL's 'setup memory' can be transferred to an intelligent storage device such as a PC, or printer or another MRL.

Contact: Esterline Angus Instrument Corporation, Box 24000, Indianapolis, Indiana 46224.

REVERSIBLE SYNCHRONOUS GEARED MOTOR

The most sturdy, compact, high starting torque, self and instant start, Geared Reversible Synchronous Motor operates on 240V or 110V ±10%V, 50 Hz supply and consumes less than 2.6 or 5 watts. The basic motor speed is 375 or 500 or 1000 RPM and with suitable geartrain output speed can be available from 1 sec/rev to 168 hours/rev. This motor can be directly used as a drive for motorised potenti-



REVERSIBLE SYNCHRONOUS GEARED MOTOR

ometers, eddy current drives, servo applications, colour photo printers etc.

Contact. Vishal Electromag Industries, D-202, Bonanza Industrial Estate, Ashok Chakraverty Road, Kandivli (E), Bombay 400101

STATIC ELIMINATION AIDS

Assembly and handling of sensitive components and sub-assemblies requires static elimination and protection from electrostatic charges. A variety of antistatic products are now being made in India These static elimination aids for electronics assembly are antistatic work stations, antistatic computer rooms, conductive rubber floorings/floor mats, conductive rubber sleeve protecters, conductive rubber aprons, conductive rubber seat covers and back rests, warning signs, antistatic component bins, antistatic plastic bags in various sizes and antistatic wrist straps.

Contact: S D Rubber Products, D-59, I.D A , Jeedimetla, Hyderabad 500855 (A.P.).

OFFLINE DATA ENTRY TERMINAL

Offline Data Entry Terminal has a 30.5cm CRT for displaying full records and formats (maximum 512 bytes) along with cursor, operation modes and error messages Detachable keyboard has ASCII alphanumeric keys, numeric pad, edit function keys Data file and directory structure are compatible to the CP/M operating system

Contact: O E/N Micro Systems Ltd, P B. No. 2, Vyttila, Cochin 682019.

PCB RELAYS

PLA introduces PCB relays which have all the salient features of their series M relays. Series PCB relays are suitable for mounting on PCB boards as the name implies and are available with 3 changeover and 2 changeover contacts with standard coil voltages of 12V and 24V DC

Contact. Sai Electronics (A Div. of Starch & Allied Industries), Thakor Estate, Kurla Kirol Road, Vidyavihar (West), Bombay 400086.

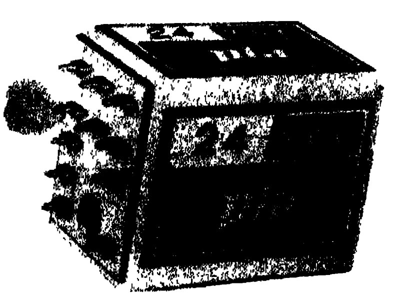


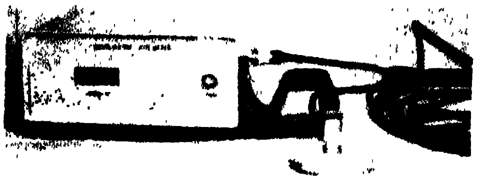
CHART RECORDER INKS

Chart Recorder Inks can be used with all types of recorders without any modification. The ink is permanent and would not fade or wash away It does not clot, dry out and works well under widely varying conditions of humidity and temperature as encountered in industrial environments Also, it does not spread on paper and spoil the recorded trace. It is neutral and non-corrosive.

Contact. Kants Master Clock Mfg Co, Clock House, 191 Saket Nagar, Indore 452001.

UNDERWATER LIGHT METER

The Under water Light Meter measures the light intensity under water The instrument has got an underwater probe which can be lowered to depths in reservoirs or ocean by means of a suitable frame The portable electronic unit operated on self-contained supply indicates the light intensity in a digital LCD meter The instrument calibrated for light energy measurements is useful for estimating the solar energy available for photosynthesis action underwater

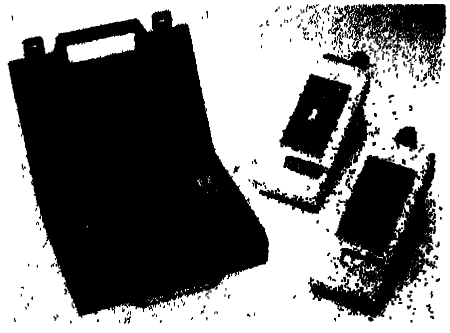


UNDERWATER LIGHT METER

Contact: Environmental System Engineers, Kadavanthra Road, Cochin 682020.

FIBRE OPTIC TEST EQUIPMENT

Three new instruments for servicing optical fibres have been launched by THORN EMI Instruments UK.



FIBRE OPTIC TEST EQUIPMENT

The optical power meter is designed to measure light emerging from optic fibres of diameter upto 1mm and is battery powered. Readings are given in dBm and displayed on an LCD readout. It can be used to determine the attenuation, splice and connector loss in an optical fibre link by measuring signal levels at either end or at various intermediate points. Fibres can be connected directly to the instrument through a versatile range of adaptors.

The optical light source injects light into an optical fibre cable of core diameter upto 1mm and enables the attenuation throughout the link to be determined. Powered either by internal re-chargeable cells or from a mains supply, OLS510 is compatible with most optical power meters and is supplied with a range of adaptors for various connector types.

The fibre optic microscope is a simple and convenient means of examining visually the ends of optical fibres and has ×100 magnification. It enables the user to examine the condition of an optical fibre when mounted in a connector, revealing such defects as dirt particles, scratches or poor finishes to fibre ends, cracks, non-concentricity of a fibre within a connector or a fibre pulling out of a connector. Good defination over an area of one square millimeter is given.

Contact: Jost's Engineering Company Limited, 60, Sir Phirozeshah Mehta Road, Great Social Building, Bombay 400001.

REMOTE CONTROL FAN REGULATOR

The Remote Control Fan Regulator system was developed for domestic and industrial applications. The system is a super high-frequency set consisting of a receiver and a transmitter with LED indicators. The set produces no flash and causes no interference to other electrical goods when used and does not infringe on the other broadcasting systems. The system utilises combined affect of frequency and amplitude modulation technique affecting unique pulse coding.

REMOTE CONTROL FAN REGULATOR

Contact: Anushya Electronics Private Limited, 1-1-714/C/3, New Bakaram, Gandhinagar, Hyderabad 500380.

UNIVERSAL EPROM PROGRAMMER

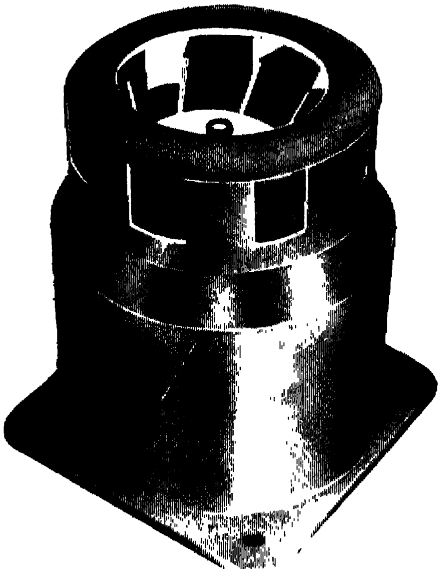
Universal EPROM Programmer uses a software approach rather than the personality module concept or harware approach. The system has been so designed that without hardware changes, it is updatable for new coming versions of memories. The system consists of user friendly software, 16 seven segment display and keyboard entry. It has got internal 8K RAM and built in UV EPROM earaser facility. This can be used as a kit with 44 I/O lines.

Contact: Protek, 88/3 Parvati, Chintàmaninagar, Janaki Apartments, Pune 411009.

MINI SIREN

Electronic Mini Sirens are used in different types of organisation either as security/emergency alarms or regular alarm. There are two types of mini sirens—one 2-minute continuous and other 30-minute continuous operation—with working voltages 230 & 110 AC.

Contact: Alltronics, Kanu-Kunj, Sayaji-Gunj, Baroda 390005



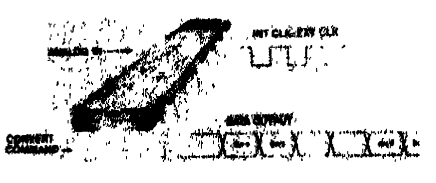
MINI SIREN

ANALOGUE-TO-DIGITAL CONVERTER

A new ADC (Analog-to-Digital Converter) requires no external components or control signals to perform a complete 10-bit conversion. This combines fast 30us conversion time with serial output features that facilitate a wide range of microprocessor/microcomputer interfacing and data transmission applications.

The operation is in two modes; a standalone continuous conversion and a trigger mode under the direct control of a microprocessor. The continuous conversion mode is pre-programmed to occur if the CONVERT control line is high at the edge of the conversion, reducing software requirements. The triggered conversion mode is set by keeping the SCAT control line low, permitting short cycling to 8-bits or conversion termination.

Contact. C H. Krishnan & Associates Private Limited, Kamal Theatre Building, Safdarjung Enclave, New Delhi 110029.

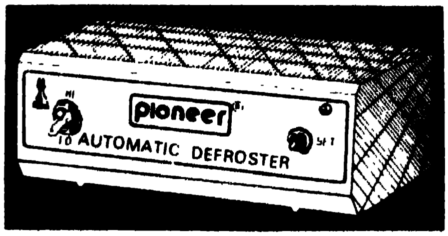


ANALOGUE-TO-DIGITAL CONVERTOR

DEFROSTER

An automatic programmable, fully solidstate Defroster for refrigerator automatically switches off supply for 1-1/4 or 2-1/2 hours daily in the dead of night, thus defrosting the ice formed on tubes of freezing cabinet This takes place daily, automatically. This not only reduces electricity charges, but increases the efficiency of the cooling system and removes the bad smell. It can be easily connected to any refrigerator by anyone.

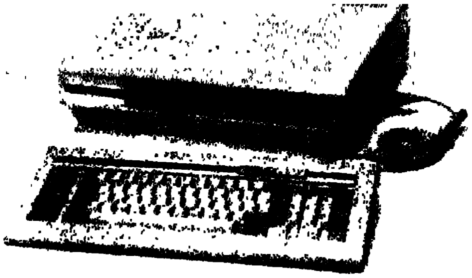
Contact Mactronix, Ground Floor, Firdaus Flats, Khanpur, Ahmedabad 380001.



DEFROSTER

U-COM2

The U-COM2 system 3 comprises the U-COM2 motherboard, PSU, display card, single floppy disk drive and 10-megabyte hard gle floppy disc drive and 10-megabyte hard disc drive—all neatly housed in a single sys-compatible with Apple II+ software and hardware add-ons.



U-COM2

It uses a xebec owl hard disc system with SASI interface. Full support software is included for disc partitioning and backup/restore operations.

Contact: U-Microcomputers Ltd, Winstanley Industrial Estate, Long Lane, Warrington, Cheshire, England.

EMULATOR

Emulators can be used to test both the hardware and the software of assembled microcomputer systems. The new emulators developed by Siemens are suited for 8-bit (8085) and 16-bit (8086, 8088, 80186, 80188) applications Menu-controlled operator guidance facilitates the dialogue.

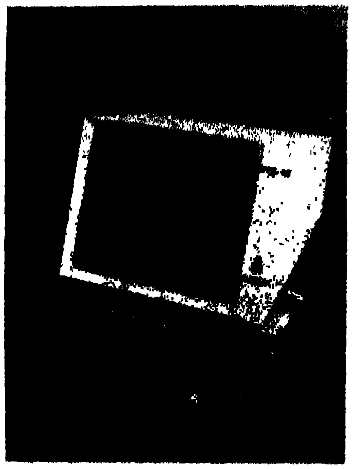
EMULATOR

The emulator's read-only memory (32-kbyte) and trace capability (up to 2048 forward or backward steps) make symbolic-level programme testing easy. Both units support single-step emulation and real-time emulation up to 5 or 8 MHz and use a variety of halt-point/interrupt criteria The first of the number of possible tests is the pure software test, using the emulator's write-read memory. The user hardware can be tested as soon as it has been connected to the emulator

Contact: Siemens AG, Zentralstelle Fur Information, Postfach 103, D-8000 Munchen 1, Federal Republic of Germany.

GRAPHIC TERMINAL

Graphic Terminal combines a standard alphanumeric terminal and a Tektronics 4010 compatible graphic terminal (GR-10) into a single terminal. GRV-10.



GRAPHIC TERMINAL

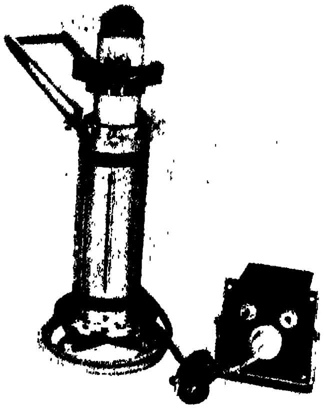
The display output of the two separate display memories—graphic and alphanumeric are superimposed. The two memories can be independently modified. It operates in 3 modes—vector, point plot and GR-alpha. Modes can be switched through software command. Other features include selective erase, memory dump, local hard copy and input cursor.

Contact: Databyte Equipment Pvt Ltd, 200 Narayan Peth, Laxmi Road, Pune 411030.

VERTICAL LASER ALIGNMENT SYSTEM

Vertical Laser Alignment System is designed exclusively for establishing a visible vertical reference line in the shortest time for alignment of tall structures, chimneys, silos, TV towers, etc. It can conveniently be placed or mounted on a levelling base for a long period till the job is complete It can function in field conditions in temperatures up to 50°C and humidity up to 60% non-condensing, on a car battery for 15 hours.

Contact: Jyoti Limited, Laser Division (Gr II), P.O. Chemical Industries, Vadodara 390003

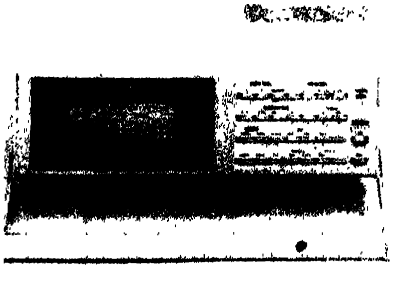


VERTICAL LASER ALIGNMENT SYSTEM

LOGIC ANALYSER

This Logic Analyser is a compact, light weight unit with 16-channel data input and 100ns maximum resolution (at 10 MHz) The liquid crystal display gives the analyser very low power dissipation in logic circuits making possible battery-powered operation (AC can also be used). It is designed to measure timing, state and signature, and can be used in many applications from hardware to software.

Contact. Khatau Engg Services Pvt Ltd, Post Box 2910, Dharmaram College Post, Hosur Road, Bangalore 560029.



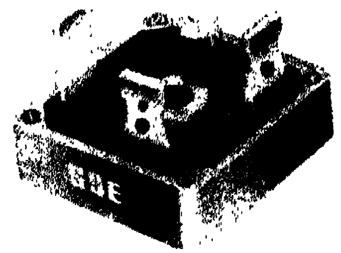
LOGIC ANALYSER

MODULAR RECTIFIER BRIDGES

isolated, high-power, single phase, full wave bridge has been manufactured by SSE. This 4-terminal device is built in a full metal body having each polarity embossed thereon The 'fast-on' termination is also suitable for wire wrapping or soldering.

SSE claims a 2500V isolation and is offering these modules in 5, 10, 25 and 35 amp (average resistive load current) ratings for RMS input voltage up to 420V RMS Since current derating graphs are given along with power dissipation graphs, user has no problem in deciding on choice of 'free-air' or 'chassis' or 'heatsinks' mounting. A single 3/16 bolt-nut-washer, completes the mounting, in any location

Contact: Solid State Electronics Co. Pvt. Ltd, Plot No 9/123, Marol Co-operative Ind Estate, P.O. Box No 7432, J.B. Nagar Post, Bombay 400059.



MODULAR RECTIFIER BRIDGES

MODEM

Data Communication Modems operates in the full duplex modem four wire line at 0 to 1200 baud rate All RS-232C status of the terminal/computer are indicated on the front panel of the modem Transmit/Receive data conditions are dynamically displayed on the front panel by LEDs.

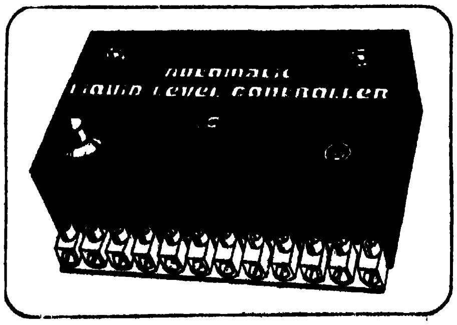
FSK (binary, phase coherent) modulation technique is used Analog loop back test facility has been implemented This will enable the user to check the modem for its performance instantly

Contact MRO-TEK Pvt Ltd, 10/1, 1st 'B' Main Road, Gangenahalli Extension, Bangalore 560032

AUTOMATIC LIQUID LEVEL CONTROLLER

Automatic Liquid Level Controller makes the pump set fully automatic by sensing the level of the reservoir and overhead tanks. Thus overflow of overhead tank and dry running of pump set is avoided. The device also provides low voltage cut-off to protect the motor from working in low voltage condition. The unit is available in three phase and single phase models.

Contact: Patron Electronics, 2421, Ghee Walon Ka Rasta, Johari Bazar, Jaipur 302003.



AUTOMATIC LIQUID LEVEL CONTROLLER

MICROFICHE INFORMATION SYSTEM

Microfiche readers can view microfiche of standard reductions at high resolution, with a grid index system to facilitate retrieval of a frame on the microfiche.

A microfiche is a 15 cm × 10 cm sheet of film, and is used as a low-cost, high-density media of retrieval and storage of both documentation and imagery. This has also led to the emergence of a number of information centres within companies, similar to a data bank. A microfiche has data storage capabilities, ranging from 1 MB to 400 MB.

Contact: Image Microforms & Systems Pvt Ltd, Era, 123, Mahatma Gandhi Road, Bombay 400023.

POWDER COATING MACHINE

A semiautomatic conformal Powder-Coating Machine incorporates a fluid bed that can be used in the 'fully fluidised' mode when coating bulky components, or in the 'dead scraped' mode when coating slim-profile components where optimum control of coating height on component leads is required. The cabinet design allows the operator to sit at the machine and component fixture loading is facilitated by a convenient three-position load rack.

All process parameters are microprocessed, while double heaters ensure adequate heating capacity for the largest parts the machine can handle. The salient features of the machine are. dipping depth adjustment by handwheel control and the ability to accept double row loading of components

Contact: Jidenco Machines International Ltd, Jidenco House, Valo Road, Windsor, Berkshire, England.

POWDER COATING MACHINE

Selected Books Available
Ask for the latest list
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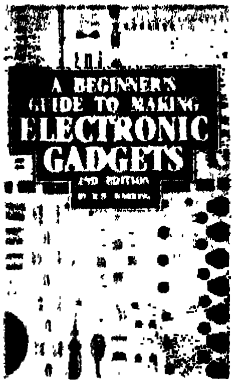
ook Reviews.



A Beginner's Guide to Making Electronic Gadgets

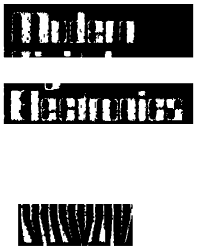
By R.H. Warring, published by TAB Books Inc., USA; pages 175 (13 cm × 21 cm); soft cover; price: US $ 8.95.

Full of easy-to-build electronics projects, this book will be an exciting companion to the beginner. Intended as a practical guide to the beginner, the book also offers down-to-earth explanations to give a sound background to the simple and easy-to-follow projects. The book gives all information that is needed on components, amplifiers, oscillators etc, so that no previous knowledge of electronics is needed to get started. This completely revised and updated second edition of the do-it-yourself guide includes many new projects on flasher circuits, intercoms, alarm circuits, thermostat circuits etc. The book contains many simple circuits and will make electronics gadget making an interesting hobby. A must for the serious hobbyist.

Using Integrated Circuit Logic Devices

By Delton T. Horn, published by TAB Books Inc., USA; pages 425 (13 cm × 21 cm); soft cover, price: US $ 15.50.

This book can change the perception of those who have been keeping away from experimenting in digital electronics, merely because of its complexity. Direct comparisons with analogue electronics are made to make digital circuitry easy to understand. The book gives a firm grounding in binary arithmetic, functions of Boolean algebra and hexadecimal system and makes mathemical concepts easy to understand. Some of the interesting projects designed include digital logic probe to study other projects, digital clock/oscillator, a bounce-free switch, LED flasher and counter projects from a single- to multi-digit binary counters and a sequential counter. Directions are also given for building a variety of other useful and entertaining counter projects like a score-keeper device, a random number generator, clocks, count-down timer etc. Very useful guide to persons hazy on principles of digital electronics.



Modern Digital Electronics

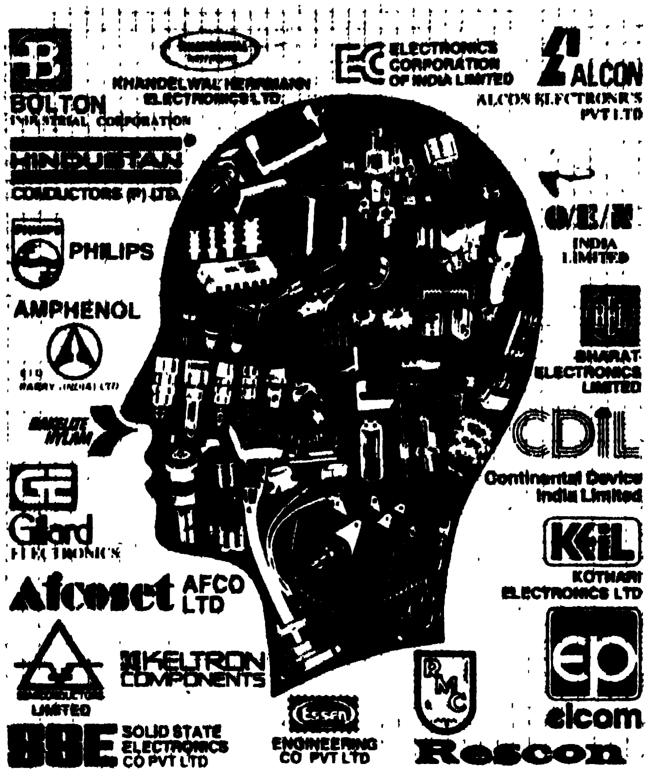
By R.P. Jain, published by Tata McGraw-Hill Publishing Co. Ltd, New Delhi; pages 468 (13 cm × 25 cm); soft cover; price: Rs 39.

The book is a simple introduction to all aspects of digital electronics. The presentation has been kept at a level that requires only a basic knowledge of circuitry and electronics. Modern digital devices such as SSI, MSI and LSI ICs have been dealt with in detail and all recent advances covered. The design of digital systems using these ICs are emphasised rather than conventional designs using discrete components. A number of examples and problems with selected answers are also provided. The book is an ideal text for electrical, electronics, computer science students.

Power Supplies Switching Regulators Inverters & Converters

By Irving M. Gottlieb, published by B.P.B. Publications, New Delhi by arrangement with Tab Books Inc., USA; pages 448 (13 cm × 21 cm); Indian edition price (hard bound): Rs 150; foreign edition price (soft cover): US $ 15.50.

This book dealing with inverters, converters and switching regulators, is divided into two parts. Part 1 provides an overview to begin with and then proceeds to theory, design and application of inverters and converters. Part 2 dealing with switching regulators, describes a number of topics concerning them. They take their place in their diverse applications alongside inductors, capacitors and integrated circuit modules—opening a new branch of electronic technology. It should prove rewarding to become acquainted with these new techniques for manipulating electrical energy. Technology has advanced far enough and switching-type power supplies are no longer considered beyond reach These have already been perfected in the research and development laboratories of the semiconductor industry, and this book provides comprehensive guidance to operating power sources from computers to TV sets.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SAINI ELECTRONICS
Pushpadant Nivas, First Floor, 3, Chunam Lane,
Dr. D Bhadkamkar Marg, Bombay-400 007. Phone : 369495

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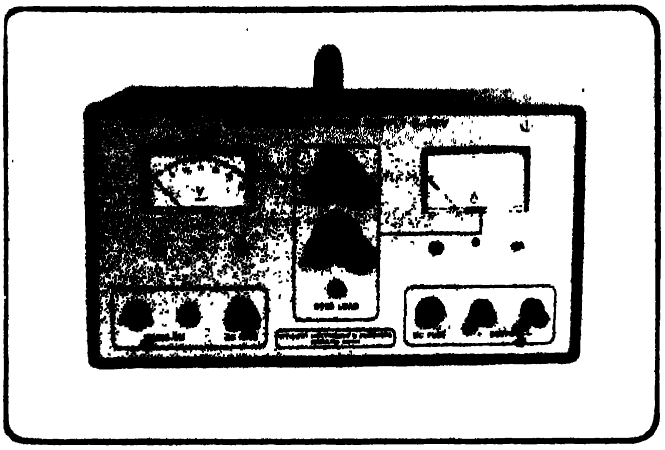

APPLICATION:
They are widely used in Electronics, Telecommunication, Digital Systems, Control Systems, Electro-Chemical Lab and Micro Computer System Labs.

Widely accepted by Central and State Government Institutions. Small Scale Industries and R&D Labs etc. They are available in variable as well as fixed output models.

SPECIAL FEATURES:
Designed with Integrated Circuit. TRIAC is used as Pre Regulator in High current/High power output models.

STANDARD MODELS:
5V, 15V, 0-30V (Single & Dual), 0-60V Single & Dual upto 20 Amps. Special Models with AC Filter for Micro-Processor 8 & 16 bit Kits and Systems.

Custom built models can also be designed and fabricated to suit your application needs.

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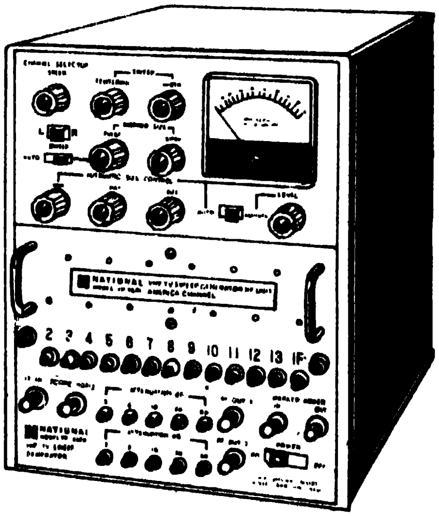
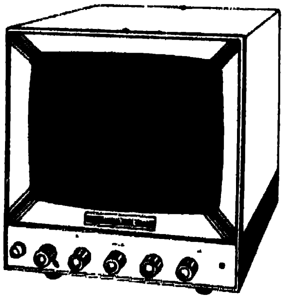


VHF TV Sweep Generator
VP-862A

- 13 channels, 10-240 MHz
- 120 dB output level
- Marker frequency, 5 pulse markers.
- EXT TRIG
- 100(H) x 430 (W) x 250 (D) mm.
Weight, approx. 5 kg



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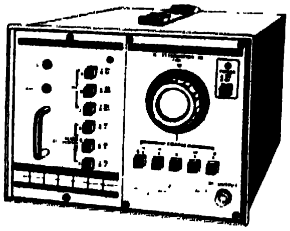

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Company Profiles

IEC celebrates silver jubilee

The Indian Engineering Company (IEC), the largest Indian enterprise in the field of switches and relays, celebrated its silver jubilee on November 9, at Bombay.

Established in 1960, with a view to promoting manufacture of electrical components, hitherto being imported, IEC now exports to 20 industrialised countries of the world including the UK, Holland, Malaysia and Hongkong. In 1983, IEC switches won an export award from the government recognised EEPC. With a turnover of Rs 88,000 in its first year, IEC now markets millions of switches annually in India and abroad, with a total turnover of Rs 40 million.

IEC caters to all electrical, electronic and automobile industries, as also machine and equipment manufacturers. IEC switches are incorporated in all the appliances and equipments which work on electricity.

Chithra International to represent TMC

Chithra International has been appointed the sole representative in India by Trak Microwave Corporation, USA, for its complete range of products.

Trak manufactures all types of circulators, isolators, crystal oscillators, DSO, FET amplifiers, custom made low-noise amplifiers etc.

L&T to make VCRs, VCPs

Larsen and Toubro is awaiting government clearance of its project for manufacturing video cassette recorders and players (VCRs and VCPs) under the licensing guidelines.

The company's Rs 240 million project, submitted for government approval, proposes to manufacture 75,000 videos every year.

Presently, BPL-Sanyo is the only company producing about 200,000 tape deck mechanisms, the core of video, every year.

Early in November '85, the ET&T (Electronics Trade and Technology elopment Corporation) signed a andum of understanding with Grundig of West Germany to manufacture videos.

The government had granted licences to some companies to make videos a few years ago. But since licensed capacity was just about 500 videos every year, there has been no genuine large-scale video manufacturing in the country.

Larsen and Toubro's project, thus, is seen as the gate-opener for large scale video manufacture.

ECIL to make 55,000 CTVs

The Electronics Corporation of India, (ECIL) is expected to produce 55,000 pieces each of black-and-white and colour TVs in the next 12 months. Distribution among different models and delivery at various centres will follow demand pattern.

The main features of EC colour TV are multichannel electronic tuner, 21cm screen size, quick-start picture tube and shutter (optional).

The black-and-white Ajantha and Premier models will have a 51cm screen while Mini Super and Minimum Marvel models will have 36cm and 30cm screens respectively.

Black-and-white TV is by and large available at most of the company's outlets, either off the shelf or within a short period of booking.

Murugappa Electronics' audio tapes project

Murugappa Electronics Ltd is setting up a project at Mysore to manufacture audio magnetic tapes with Japanese technology. The company plans to extend this facility at a later stage by diversifying to manufacture video tapes and cassettes, floppy discs and other magnetic media.

The company is also planning to enter other high technology areas of electronics such as telecommunications, computers and instrumentation with suitable collaborations.

The magnetic media plant will be the largest of its kind in the country and the most sophisticated. The plant capacity would be for about 2350 million running metres (MRM) of cassettes-width tape. Its capacity is equivalent to about 25 million tape lengths of 60 minutes duration.

The company is collaborating with Okura & Co. of Japan which is one of the largest trading companies in Japan. The knowhow for manufacturing audio magnetic tape is being provided by Cent Plan Ltd, who have considerable experience in both audio and video magnetic tapes and have set up similar plants in Japan and other places. Key equipment and machinery are being supplied by Ishida Iron Works, who supply similar equipment to leading companies in this field in Japan and elsewhere.

The Japanese technology which the company is being provided is the latest and would enable it to progress further into the field of video tapes, floppy discs, etc and produce world-class audio magnetic tapes suitable for high speed duplication like TDK, Maxell, etc.

The company also plans to convert part of its tape output into cassettes to be sold as a premium brand product. The marketing of branded cassettes would be done nationally to provide for high market share and low unit marketing cost. The company will be marketing about 5 million cassettes in the first full year of operation, with this volume going up to about 12 million by the third year of operation. Balance quantity of the tape produced by the company would be sold to other users of audio magnetic tapes, i.e. recording companies and cassette manufacturers.

The company has already placed orders for all the plant machinery and construction work is nearing completion. It hopes to start production trials by April '86 and go into commercial production by middle of April.

Modi Xerox plant inaugurated

The Modi Xerox Plant, one of the world's most advanced xerographic copier plants, was inaugurated at Rampur (UP) on November 15 by Giani Zail Singh, President of India.

Modi Xerox is a joint venture between Modi Rubber Ltd and Rank Xerox Ltd. It is the latest advanced technological collaboration in the Xerox group of companies consisting of Xerox Corporation, USA, Rank Xerox Ltd, UK and Fuji Xerox, Japan. It is the first high technology project of its kind in India and will ensure that advanced xerographic products are manufactured and sourced in India.

The first product off the line is the Modi Xerox 1045, a high speed state-of-the-art copier which can churn out over 2000 copies an hour. 7000 man-years of research and engineering have gone into its development. Xerox spent over Rs 6,000 crores in 1984 in research and development in the United States, Europe and Japan.

SCL makes semiconductor chips

The Semiconductor Complex Limited (SCL), a public sector undertaking, is manufacturing indegenously, semiconductor chips required for the manufacture of clocks.

The SCL's present capacity for chips is over four million a year. Since this is far in excess of the local demand of 30,000 estimated for 1985-86, the SCL is making efforts to sell chips in foreign markets.

According to Shivraj V. Patel, minister of state for Electronics, in the current financial year, pulse dialler has been exported to Hong Kong and orders have been received for clock chips from West Germany which are under execution

Keltron bags order from Navy

The public sector Kerala State Electronics Development Corporation Limited (Keltron) has secured a Rs 40 million order from the Naval Headquarters, New Delhi, for the supply of sophisticated electronics packages to the Indian Navy.

The electronics packages will be manufactured by the Defence Electronics division of Keltron. Earlier this year Keltron also secured similar orders worth Rs 22 million from the Indian Navy.

CTV technology to be indigenised by '88

All components of the colour TV receiver are likely to be indigenised by 1988.

Expressing this hope in the Lok Sabha, Mr Shivraj V. Patel, minister of state for Electronics said, based on present approvals, production of CPTs, a majority of ICs and semiconductors is likely to commence in 1987 and that of deflection components, tuners, SMPS power supply and delay lines in 1986. Together, the above named components account for 80 per cent material cost of the CTV receiver, now being imported.

The minister also informed the members that Bharat Electronics Ltd (BEL) had developed a CTV design (as reported in November '85 issue of EFY) and that this design would be available to any party willing to adopt it

However, it is unlikely that this will make a significant impact on the material cost of the CTV set since the BEL design incorporates only a small per cent of the BEL components, he said.

APEL TV Released

With the introduction of its 51cm black-and-white and colour TV sets, APEL (Andhra Pradesh Electronics Development Corpn Ltd)has made its entry into the market since November. Entrusted with the responsibility of promoting electronics industry in the state by the government of Andhra Pradesh, APEL has provided equity participation, marketing, project and technical consultancy in many areas—from computers to voltage stabilisers, defence projects, power supplies, battery chargers and even geophysical instruments.

Incorporated in 1980 as a subsidiary of AP Industrial Development Corporation Ltd (APIDC), it is today an independent corporation formulated to develop entrepreneural, industrial and technological base in the state through its many ventures. APEL intends to disperse electronics industries through three primary growth centres at Vijayawada, Warangal and Tirupati, and three secondary centres at Anantapur, Kakinada and Nizamabad—from communication industries to office automation equipment.

Under the corporation's marketing assistance, the products of small scale industry are bought and sold through outlets all over the country. It has established an R&D centre at Hyderabad to develop technology. APEL renders sales, finance, quality control and after sales servicing and plans to diversity its product range in Seventh Plan with forays into solar products, weighing machines, VCRs and electronic wall-clocks and table clocks, with a total investment of Rs 2,500 million (1985-1990) and an expected turnover of Rs 7,000 million.

Debikay's joint venture with Allen-Bradley

Industrial Automation is the field chosen by Debikay group for a joint venture with America's Allen-Bradley International Ltd. The new venture, A.B. Controls Ltd, has been set up at Sahibabad, near Ghaziabad neighbouring Delhi. Another factory is expected to come up during 1986 in Bhimtal, near Nainital in UP.

Computerised industrial automation is not entirely a new field in India. Companies like Siemens India and Larsen and Toubro are already at it, though these are comparatively recent ventures.

The hardware that the new company promises includes computerised numerical controls, uninterrupted power supplies, AC and DC drives, industrial computers, programmable controllers and integrated automation systems. What is more important however, is the introduction of system house development, a new concept in India The company would promote several independent system houses which would buy the hardware from A.B Controls but do their own systems engineering for different applications. A.B. Controls will provide training and back-up to such groups.

A B. Controls is a closely-held public limited company. The Debikay group holds 61 per cent shares and Allen-Bradley 39 per cent. The latter partner incidentally, now forms a part of Rockwell International in USA, a global giant with interests in aeronautics, automobiles, avionics, electronic components, printing, space technology etc.

The Debikay group started its activities in electronics in mid-1975. Since then, besides industrial automation products like thyristor drives, battery chargers and programmable automation, it has also introduced a range of electronic typewriters. In August, it received licence for fascimile equipment and also intends to introduce TV and audio equipment soon.

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FOREIGN COLLABORATIONS

(Approved between July and September, 1985)

Name & Address of the Indian Firm (1)	*Name & Address of the Foreign Firm* (2)	*Item of Manufacture (Nature of collaboration)* (3)
Usha Didak Ltd Jeevan Tara, 5 Parliament Street New Delhi 110001	Didak Manufacturing Co Ltd Canada	Floppy diskettes (Financial)
Central Electronics Ltd NPL Campus Hillside Road New Delhi 110012	Siemens of West Germany	P&T element to be used as a component in push button telephones (Technical)
Hindustan Photo Films Mfg Ltd Indunagar Ootacamund 643005	Magna Tontrager Production GmBH, Berlin West Germany	Magnetic tapes (audio MSR film video & computer tapes) (Technical)
Sandur Manganese & Iron Ores Ltd Lohadri Bhavan', Yeshwantnagar Distt Bellary Karnataka 583124	Chemie Und Filter West Germany	Electronic dosing pumps (Financial)
United Watches Ltd 107 110 Sector 17-B Chandigarh 160017	Telefunken Electronics GmbH West Germany	Electronic tuners (Technical)
The Aluminium Industries Ltd 1, Ceramic Factory Road, Kundara Quilon, Kerala 691501	Alsthomatlantiq France	Relays (Technical)
Super Deal Investments Ltd P-16 New City Road Calcutta 700073	Veb Elktro-Consult Berlin GDR	Soft ferrites (Technical)
Lumax Industries Ltd 63-64 Gokhale Market Delhi 110054	Plassey SPA Italy	Flywheel magneto, Electronic voltage regulator & electronic ignition (Technical)
Toshniwal Instruments (Bombay) Pvt Ltd 8, Mohatta Bhavan Off Dr E Moses Road, Worli Bombay 400018	Dani, SPA Italy	Gas chromatograph integrators microprocessor based (Drawings & designs)
Bundy Tubing of India Ltd Tiam House 28 Rajaji Road Madras 600001	Fuji Electrochemicals Co Ltd Japan	Soft ferrites (Technical)
Electronics Corpn of India Ltd ECIL P O Hyderabad 500762	NEC Corporation, Tokyo Japan	Digital fascimile transreceivers (Technical)
Indian Duplicator Co Ltd 114 Dr Lal Mohan Bhattacharjee Road, Entally Calcutta 700014	Copyer Co Ltd Japan	Plain paper copier (Technical)
Instrumentation Ltd Kota (Rajasthan)	Fuji Electric Co Ltd Japan	Differential pressure and pressure transmitters (Technical)
Morris Electronics Ltd Bhosari Indl Estate Pune 411026	Nippon Ferrites Ltd Japan	Soft ferrites components (Technical)
M P Uni Magna Tech Ltd E 1/23 Arora Colony, Bhopal Madhya Pradesh	Toshiba Corporation Japan	Body scanners ultrasound (portable gynec & cardiac) (Technical)
Ramesh Kundalia Kusumanjali 6-3 883/12/A Panjagutta Hyderabad 500004	1 Action Computers (Pte) Ltd, Singapore 2 Action Computers Enterprises Inc, USA	Multi-user, multi processor, super microcomputer (Financial)
Emco Transformers Ltd 106, Industrial Area Sion (East) Bombay	A De Sech Switzerland	Voltage regulators (Technical)
Hindustan Brown Boveri Ltd Brown Boveri House Race Course Circle Baroda 390007	BBC Brow Switzerland	Mini computer microprocessor based systems (Technical)
O/E/N Micro Systems Ltd P B No 2 Vyttila Tripunithura Road Cochin 682019	[illegible]	Professional grade micro stepper motor (Technical)
Oak India Ltd 31 Netaji Subhas Road Calcutta 700001	Wus P Taiwan	Printed circuit boards (Technical)
Taylor Instrument Co (I) Ltd 14, Mathura Road, P O Amar Naga Faridabad 121003		Multipoint recorders (Designs & drawings)
B F Dabhoiwala 14 B, Carter Road, Bandra Bombay 400050	[illegible]	Switch mode power supplies and microwave monitors (Financial)
Best & Crompto 29, Rajaji Salai Madras	Terra Light USA	Solar thermal systems for domestic commercial and industrial applications (Financial)
Digital Electronics Ltd 74 II Marol Industrial Area MIDC Andheri (East) Bombay 400093	Houston Instrument Division of Bausch & L Inc.,USA	Plotters & digitisers
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Indmag Pvt Ltd 201 Raheja Centre 214 Nariman Point Bombay 400021	Xidex Corporation USA	Precision flexible discs for microcomputer word processors and small business machines (Technical)
International Computers Indian Mfg Ltd Mile Post 4, Ahmednagar Road Pune 411014	Centronics Data C Corpn USA	Line printers line writers (Technical)
Kirloskar Electric Co Ltd Post Box No 5555 Malleswaram West Bangalore 560055	Fortune Systems C USA	Micro mini computer systems (Technical)
Larsen & Toubro Ltd L&T House Narottam Morarji Marg Ballard Estate Bombay 400038	Gould Inc USA	Electronic test and measuring instruments (Financial)
Pasadena Electronic Modular Systems Pvt Ltd E-42/3, Okhla Industrial Area Phase-II New Delhi 110020	EMC Inc USA	Micro mini computer microprocessor based systems (Financial)
Pine Chemicals Ltd Jehangir Building 133, Mahatma Gandhi Marg Bombay 400023	Packaging Industrie Group Inc Hyannis, USA	Computer diskettes (Financial)
Bihar State Glazed Tiles & Cer Industries Ltd West Boring Canal Road Patna 800001	Iskara Commerce Yugoslavia	Hard & soft ferrites (Technical)
Kerala State Industrial Development Corpn Ltd Keston Road Kawdiar Trivandrum 695003	Iskara Commerce Yugoslavia	Ferrites magnets (Technical)
M L Tandon 37, Morry Niketan Mt Mary Road, Bandra (W) Bombay 400050	Tandon Corporatio USA	Winchester head stack and drives (Financial)
Marine & Communication Electronic (India) Ltd Parisrama Bhavan 5 9-58/B Fateh Madan Road Hyderabad 500029	Southeum Internati USA	HF SSB synthesised transreceivers (Technical)

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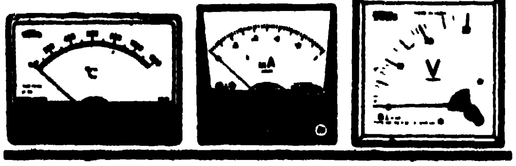

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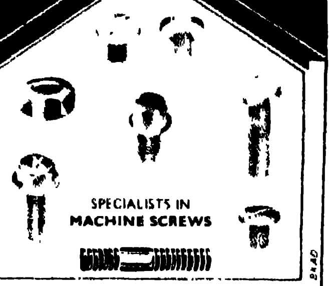

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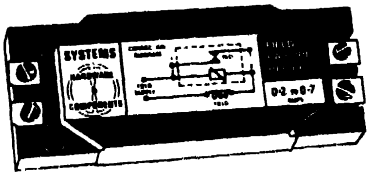

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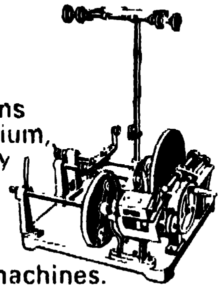

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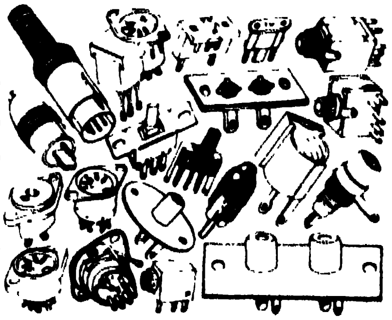

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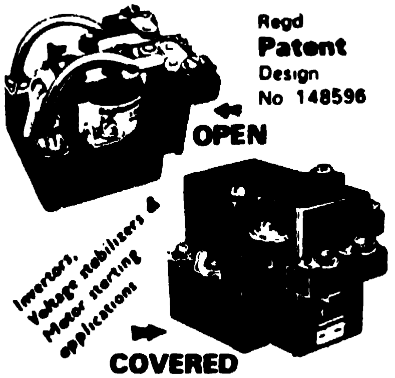

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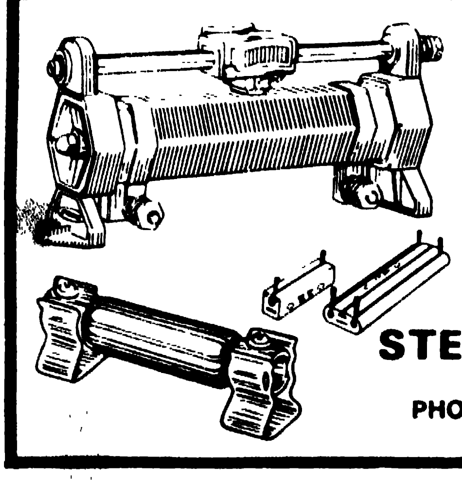

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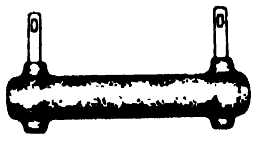

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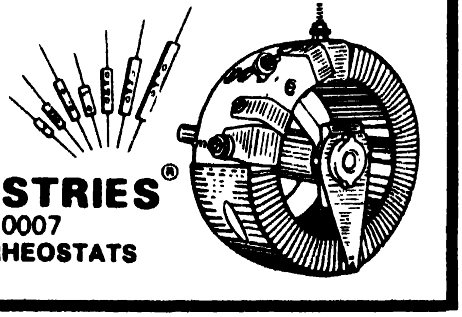

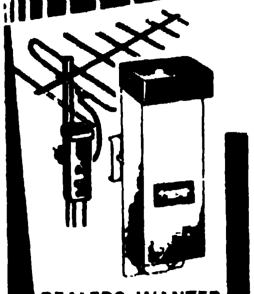

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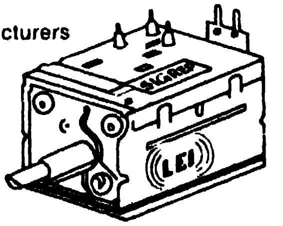

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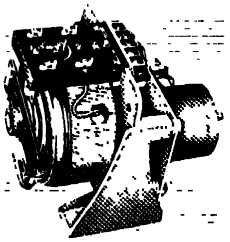

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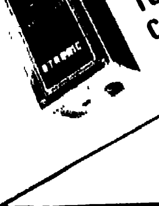

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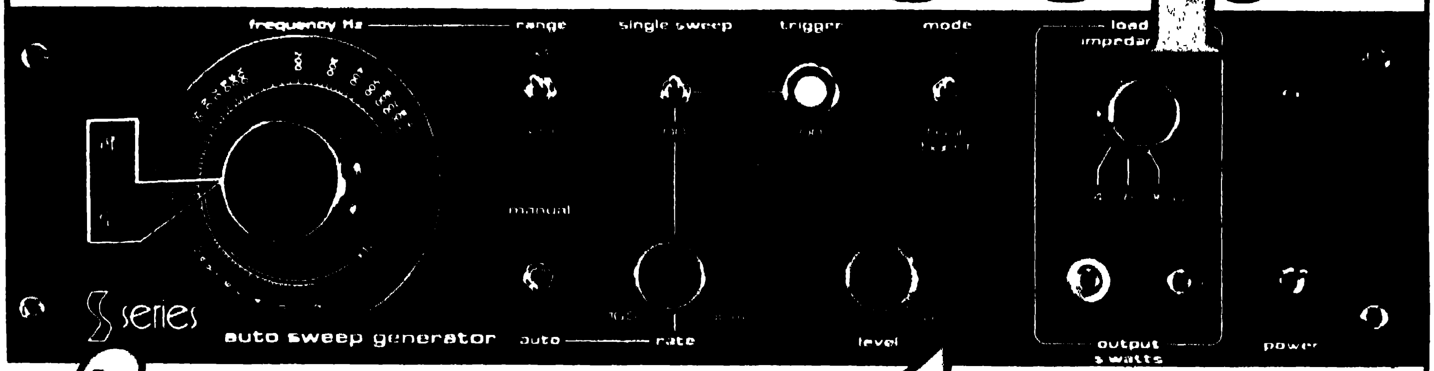

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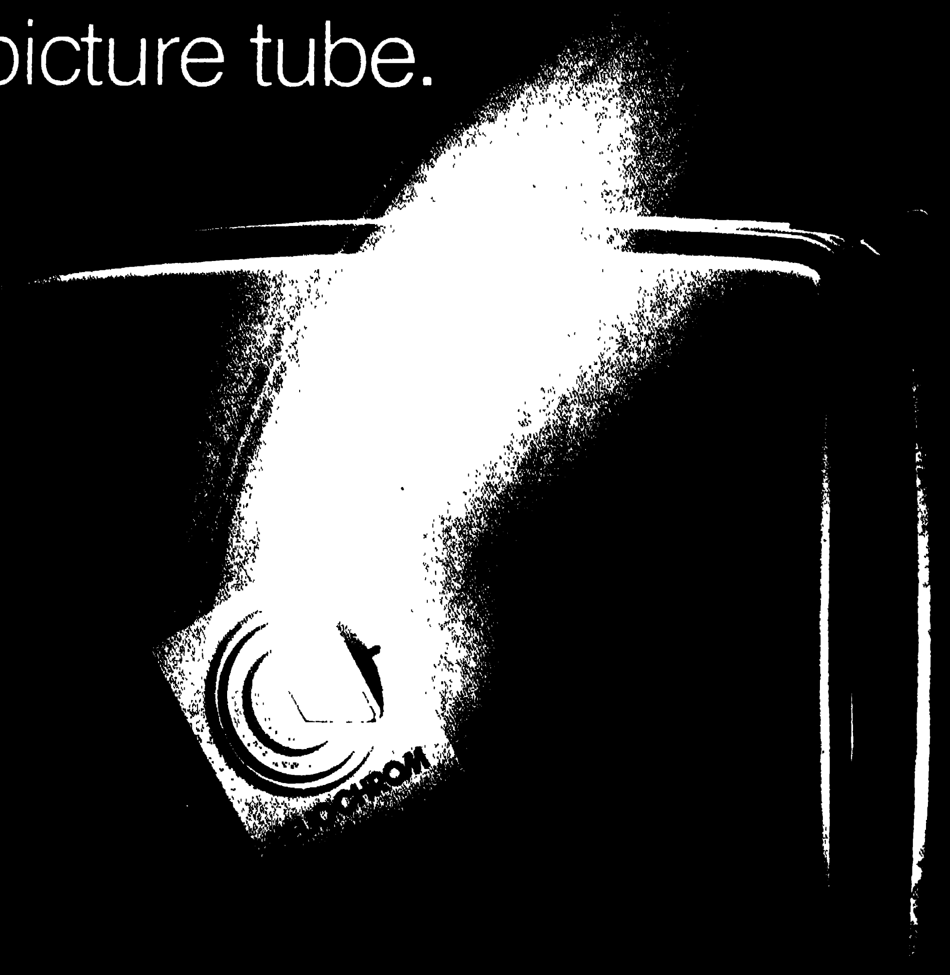

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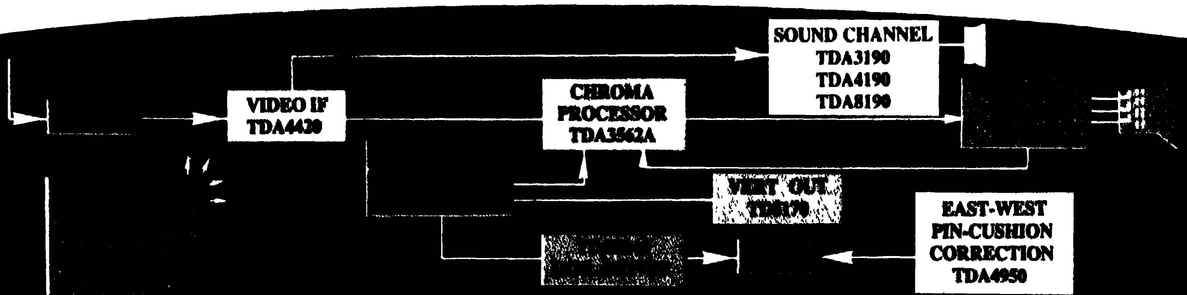

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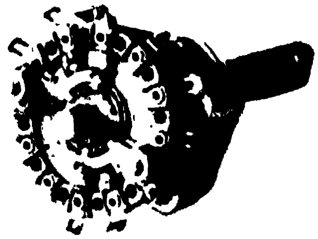

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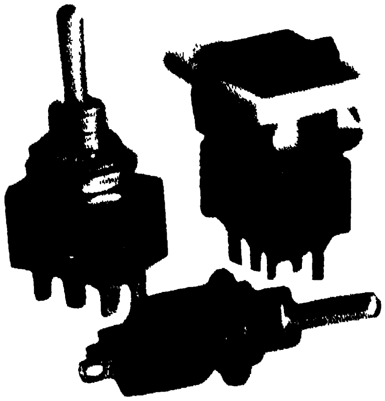

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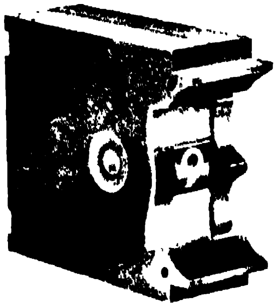

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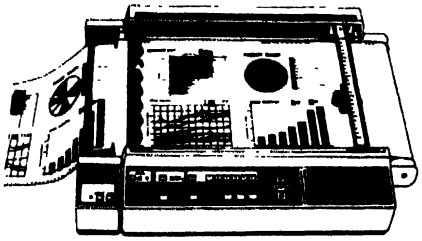

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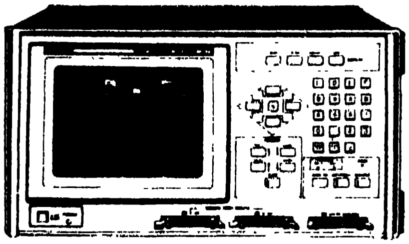

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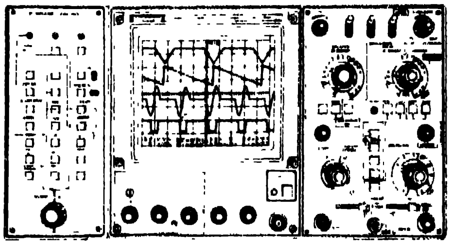

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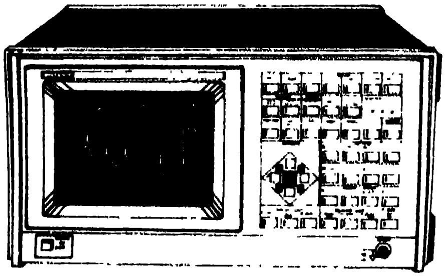

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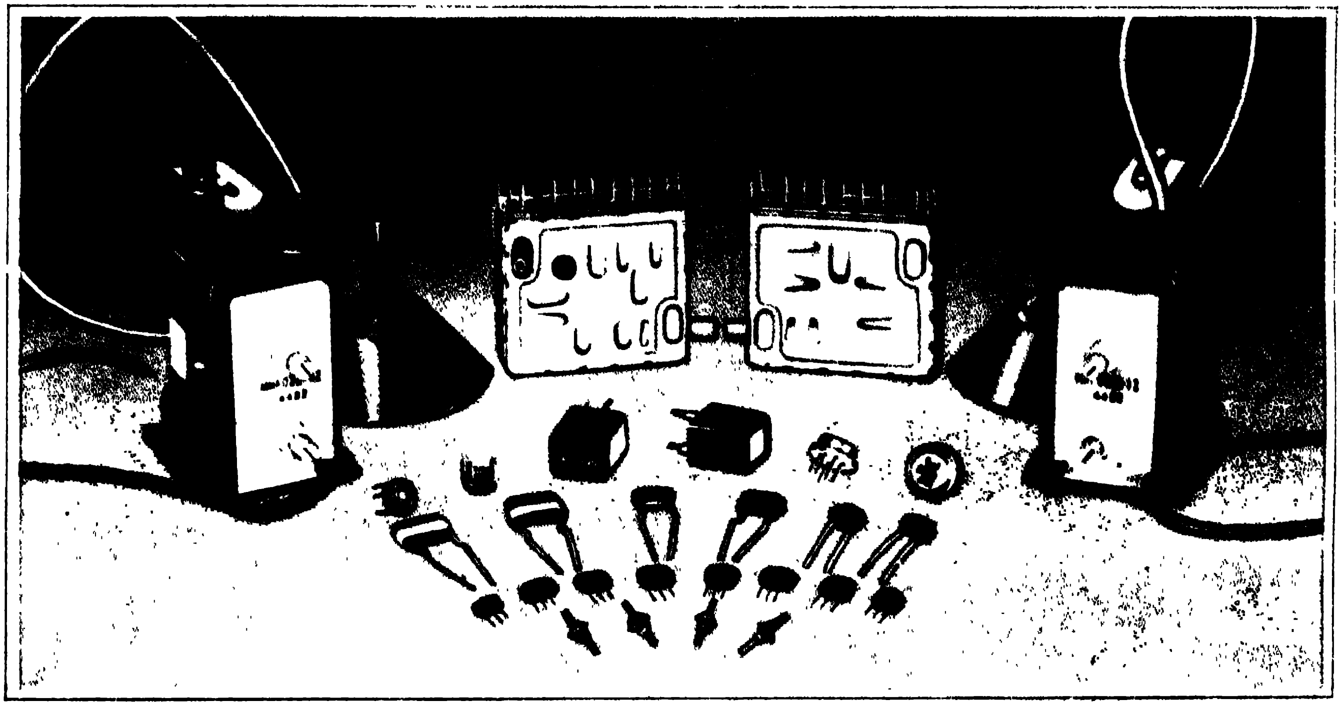

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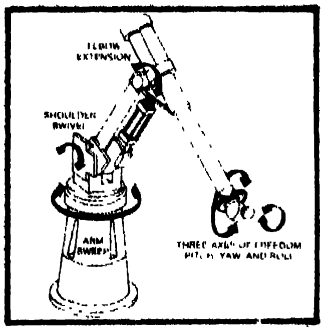
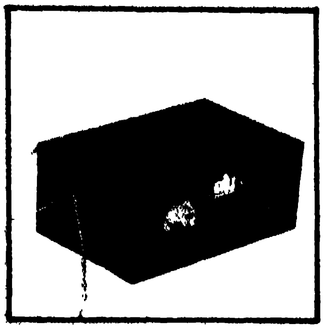
Are Robots Coming

33 With the accent on precision and speed, automation in industry has become imminent and with it the use of robots. Applications, installation, current international robotics trends and safety measures required while working with these 'man machines' are discussed in this article.

—Dr N. Vanvari





Automatic AC Voltage Regulator

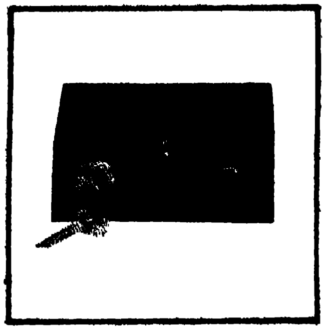
70 A number of solidstate automatic voltage regulators are available in the market. But in most of them, the controlling elements are usually relays or motor-driven variacs and cannot truly be termed as 'solidstate'. Here is a 'true' solidstate voltage regulator without a single moving element in the circuitry.

—Balakrishna P.

STD/Local Bar

76 Over-charging of telephone bills is not an uncommon occurence in India. One prime reason for this is the use of the STD facility in proxy. This simple STD/Local bar instrument enables the subscriber to switch the STD facility on or off as and when required.

—P. Jayavardhana Krishnan



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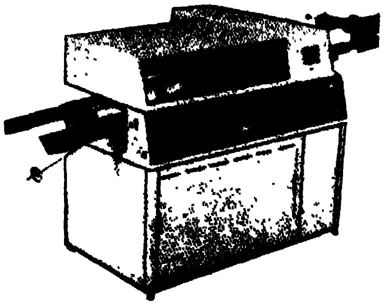

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KAVERI

Programmable Volume Control

This refers my 'Programmable Volume Control' circuit idea in EFY's November issue. Two mistakes have crept up in the article First, the last line of the text is wrongly printed as "R11 is about 47 kilohms for the zener diode used" It should be read as "R11 is about 47 ohms for the zener diode used" Second, the pull-down resistors connected to the BCD thumbwheel switch are marked R11, R12, R13 and R14 They should have been marked as R12, R13, R14 and R15 respectively

BIDYUT CHAKRABORTY
Distt Nadia, W.B

Inexpensive Multitester

Kindly refer our circuit idea captioned 'Inexpensive Multitester' published in December issue of EFY

In the circuit diagram, the switch numbers have been wrongly printed. S2 shall come in place of S1 and vice-versa

We would like to take this oppurtunity to add that if anyone faces a difficulty with the use of transistor 2N481 for T3, as specified in the diagram, he may use BC158B in place of 2N481, with identical terminal connections. Only alteration required in the other part of the circuit is the use of 22kilohm resistor for R5 in place of 1k specified in the diagram This modification shall be useful when someone finds a slight glow in the indicator LED with the test prods unshorted while the unit is powered on and switch S2 is kept at 'test' position

ARUP KUMAR ROY
AND BHABENDRA NATH PAL
Calcutta

Hourly Chime for Digital Clock

Mr A Kadarkarai's article in May 1985 issue was interesting but I noticed a few discrepancies

C10 is shown connected between IC4's pin 6 and ground in circuit diagram, though it is not shown in the components layout for PCB! Similarly, C5, included in parts list, is missing from the circuit diagram

G SAHA
Gauhati

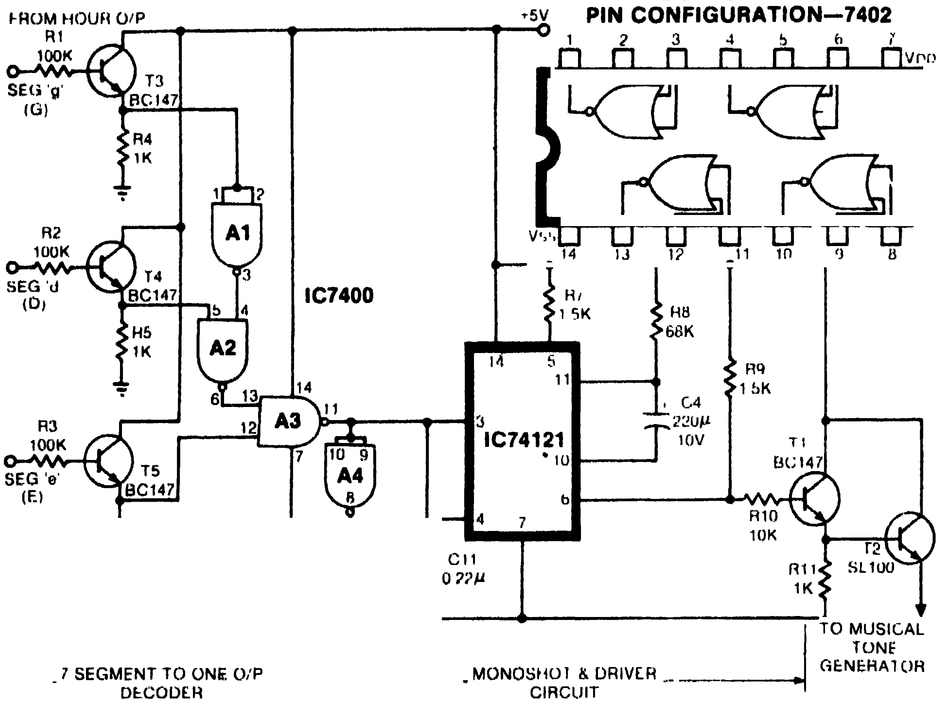
□ The author uses two ICs to get 'high to low' or 'low to high' transition alternately, by taking 'a', 'f' and 'e' outputs of hour output of the clock chip. The same decoding of 7-segment output can be done using just one IC as given here. Instead of 'a', 'f' and 'e' take 'e', 'd' and 'g' outputs The IC7400's NAND gates A1 to A3 do the decoding and output a transition every hour as required by the monoshot circuit

The IC7400 NAND gates are used only for 'low true' output clock chips. For decoding 'high true' output devices, use IC7402 and replace each NAND gate with a NOR gate, with the same interconnecting wiring IC7402's pin configurations are given here as they differ from IC7400.

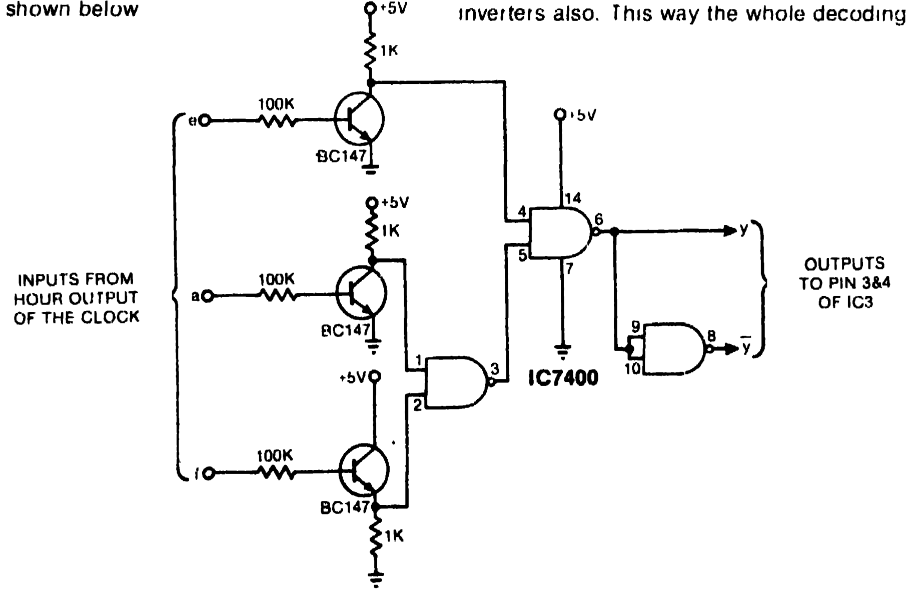
R MURALI KRISHNAN
Srivilliputtur (TN)

HOURLY CHIME CIRCUIT—(SIMPLIFIED)

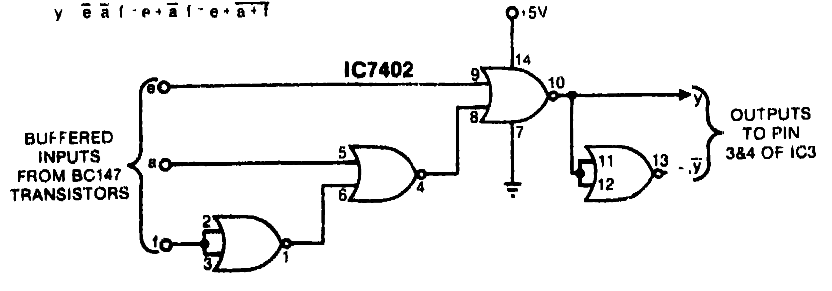
BOTTOM VIEW
PIN CONFIGURATION—7402



□ AND gates (A1 and A2) are wrongly shown like NAND gates in the circuit diagram Further, the decoder circuit can be simplified as shown below


+5V
1K
100K
e
BC147
a
f
INPUTS FROM HOUR OUTPUT OF THE CLOCK
IC7400
y
ȳ
OUTPUTS TO PIN 3&4 OF IC3

$$y \quad \bar{e}\,\bar{a}\,f \cdot \overline{e + \bar{a}\,f} \cdot \overline{e + \overline{a + f}}$$


+5V
IC7402
BUFFERED INPUTS FROM BC147 TRANSISTORS
e
a
f
y
ȳ
OUTPUTS TO PIN 3&4 OF IC3

This reduces the number of gate ICs to just one With a slight change in the BC147 transistor's connections, they can do the function of inverters also. This way the whole decoding circuit reduces to just three NAND gates which can be obtained from a single 7400 IC.

YOGISH KUMAR K
Puttur D.K

The author, Mr. Kadarkarai, replies:
Capacitor C10 mentioned by Mr Saha may be omitted but 5μF capacitor may be replaced by a 6.4μF. C5 mentioned in the parts list is not required

The decoder circuit can be simplified as pointed out by Mr Yogish Kumar But the NOR gate circuit is having some mistake In the diagram 'a' and 'f' should be interchanged.

Mr Murali Krishnan's idea is very correct and interesting. It will work for both 'active high' as well as 'active low' output clock chips.

New Policy Measures in Electronics

The above article serialised in October, November and December issues of Electronics For You, was based on various policies and procedures concerning electronics industry announced by the government from time to time These evolved out of a collective work of a number of experts engaged in the field of electronics and collegues working in the Department of Electronics, Electronics Commission (IPAG) and other ministries. Therefore, I claim no credit for the work except compilation of various facts and figures already available through different documents. No personal attribution should be made about statements in the article as they are a reiteration of the already announced policies.

Dr S.L SARNOT
Additional Director
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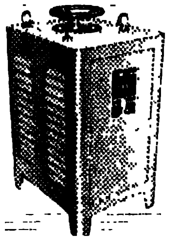

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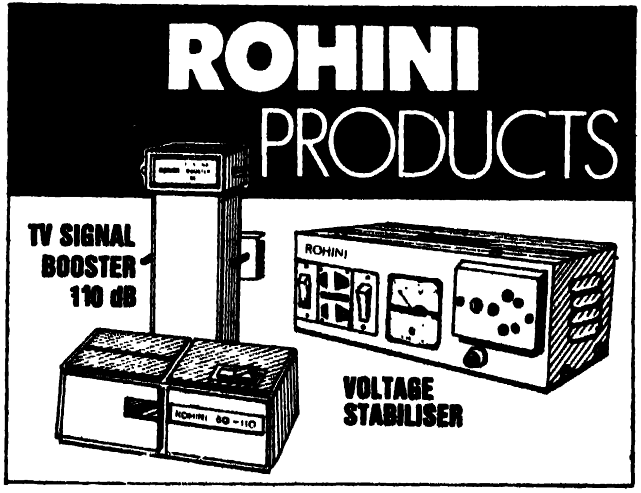

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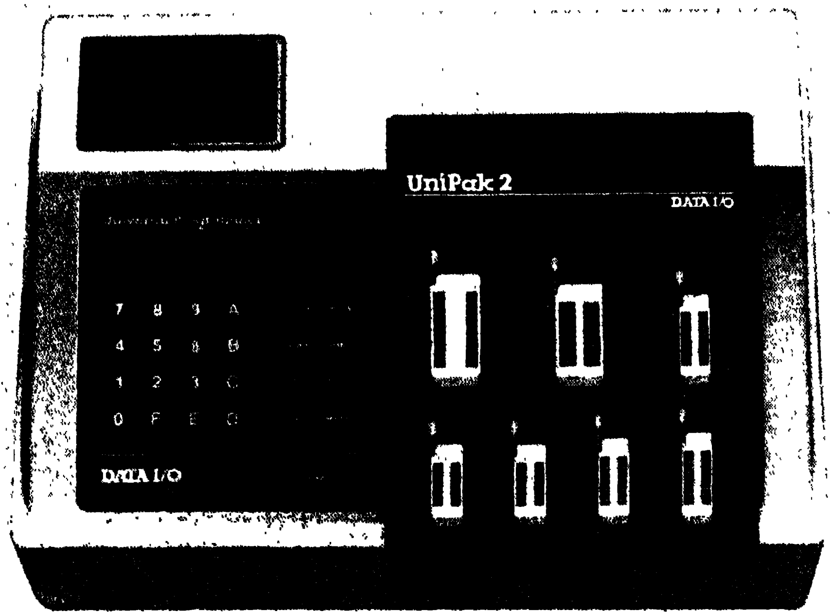

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IN INDIA....

12th AIMTDR Conference

The 12th All India Machine Tool Design and Research conference is scheduled to be held at the Indian Institute of Technology, New Delhi between 10th and 12th December 1986.

The conference serves as a forum for exchange of ideas on topics of current interest pertaining to design, performance, retrofitting and maintenance of machine tools, manufacturing systems, automation, CNC, DNC, CAD, CAM, CIM, FMS, robotics, adaptive control, microprocessor applications, expert systems, metal cutting, metal forming, non-traditional machining processes, metrology, research, development and application in the field of machine tools. It aims at bringing together research workers and practising engineers so that their work could be reported, recent developments discussed, and the latest trends assimilated.

Eminent national and international experts will be invited to participate and deliver keynote addresses on recent advances in vital areas at the conference.

Authors can send original papers in the above fields for presentation at the conference.

IETE's 32nd Annual Function

The Institution of Electronics and Telecommunication Engineers will hold its 32nd annual function from February 15-21, 1986 at Pragati Maidan, New Delhi. Mr P.V. Narasimha Rao, Minister for Human Resources Development will inaugurate the function on 15th February.

Invited and contributed papers will be presented during the technical convention of the function in the following subjects: Communication including acoustics, opto-electronics, signal processing and broadcasting systems, computers and control; office automation; circuits, systems and devices; instrumentation and measurement including industrial electronics electromagnetics including antennae and microwaves.

An exhibition, the IETE Expo '86, will also be held to highlight India's progress in the field of electronics and telecommunication.

The exhibition will relate to current and emerging technologies in telecommunication equipment, instruments, computers, microprocessors, word processors, digital electronics, process control, power electronics, microwave subsystems, components, consumer electronics and defence equipments.

The technical convention will provide a forum to professionals from diverse specialisations to come together for mutual exchange of ideas on current topics of interest in the evergrowing field of electronics and telecommunications.

Tamper-proof, computer-readable passports

The government is likely to introduce, in the next few years, computer-readable passports to arrest tampering with them and to expedite immigration and emmigration clearance procedures.

Efforts are being made to acquire optical character reading (OCR) computer which can read and write, and it is expected that by 1990 the format of the passports would be changed suitably to make them computer-readable.

According to Mr Jogesh Tiwari, joint secretary (passports) in the ministry of external affairs, computers installed at the airports would tally signatures or thumb prints in a passport with those in record and thus tighten security.

The first passport in the new format is likely to be issued three years from now and soon after all passports would be changed to the new format.

A feasibility study has already been conducted to computerise passport records in India and Indian mission abroad. He said, in early 1986 passport centres at Delhi, Bombay, Madras and Cochin would be computerised and by 1990, all passport offices linked through the computer.

Electronics units urged to cut costs

Dr M.S. Sanjeev Rao, chairman of the Electronics Commission, has warned the electronics industry that it had no option but to improve the quality and cut down the costs of electronics goods in the country.

Inaugurating a workshop on electro-acoustic measurements, Dr Rao referred to the rigid standards demanded by the international markets and said Indian goods left much to be desired in this aspect.

Underlining the importance of electro-acoustics, Dr Rao said that the production of electro-acoustic devices was projected at Rs 2500 million in 1989-90. This amounted to one-tenth of the entire production of consumer electronics estimated at Rs 25,000 million. These devices had to be highly reliable for ensuring the quality of various electronic products such as television sets and loudspeakers.

Later Mr S.R. Vijayakar, secretary, Department of Electronics, said that if Indian electronics industry wanted to make a dent in the international market, it must set its eyes on export of electronics goods. This could be possible only if the Indian electronics industry improved the quality and reliability of end-products and geared itself up to face stiff international competition.

British aid for CLASS project to continue

Sir Crispin Tickell, permanent secretary of Britain's Overseas Development Administration (ODA), the 'aid' wing of the British Foreign and Commonwealth Office, visited India in December last to discuss various aspects of the British bilateral aid programme to India.

During his stay, Sir Crispin also visited a school which is part of the government's Computer Literacy and Studies in Schools (CLASS) project. Britain has provided £1.3 million in aid to finance this pilot project, launched last year to provide BBC Acorn Model B microcomputers for 250 secondary schools and 50 resources centres throughout India. Software and training—both in the UK and in India—have also been provided as part of the package. A proposal for the provision of a further £1.1 million of UK aid for an extension of the pilot project is currently being considered.

The British evaluation report of the CLASS project made the following recommendations: (a) continued British assistance in specific ways—training both in Britain and India, exchange of information and of facilities relating to the present machine as they are developed, and (b) as the training needs become more specialised great care be taken in asessing precise needs and developing specific training courses to achieve them.

Peter Scopes, ODA education adviser, has also recommended further ODA assistance for three years.

Hike in TV prices likely

The prices of colour and black-and-white televisions are likely to shoot up by Rs 1000 to Rs 1500 and Rs 500 to Rs 700 respectively in the coming months. This follows the proposed adoption of the new central excise tariff by the centre which proposes to hike excise duty on electronic components from 15 per cent at present to 40 per cent ad valorem, according to Mr Sunder T. Vachani, president of Indian Television Manufacturers' Association.

The excise duty component of a colour TV priced Rs 6000 which is presently Rs 900, is expected to shoot up to Rs 2400. This will be exclusive of the sales tax and octroi.

Small-size TV sets, not exceeding 36 cm, which were earlier exempted from excise duty will also be subject to this hiked duty

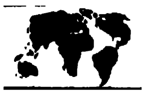
In the case of a few other electronic components, an excise duty of 20 per cent is proposed to be levied even though these were totally exempted by the union Finance Ministry through a notification on March 17, 1985. These electronic components include resistors, connectors and relays.

Foreign tie-ups for picture tube production

Two foreign collaboration proposals were approved by the central government in the area of colour TV picture tubes, one from Punjab Display Devices Ltd—a subsidiary of the Punjab State Industrial Development Corporation (PSIDC), for collaboration with Hitachi Limited, Japan and the other from U.P. Electronics Corporation Ltd, Lucknow for collaboration with Toshiba Corporation and Mitsubishi Corporation Ltd, both from Japan.

Giving this information to the Lok Sabha, Mr Shivraj V. Patil, minister of state for Electronics, said in response to a question that foreign collaboration proposal from A.P. Electronics Development Corporation has not yet been received.

In response to another question he said a working group has been set up by the IDBI (Industrial Development Bank of India) in consultation with the Department of Electronics for helping in the speedy processing of loan applications for the electronic components industry.



..AND ABROAD

Semiconductor'86

Two fairs, CEX '86 (International Electronic Components and Equipments trade fair) and Semiconductor'86 (International trade fair for Semiconductor, Manufacturing, Processing, Assembling and Testing) will be held in Korea from 27th to 30th March, 1986.

Semiconductor'86 will hold a major technical conference with a program featuring industry experts in a wide-ranging series of discussions of state-of-the art semiconductor processing, assembly and testing and wafer fabrication and processing.

Indian visitors will get a unique opportunity to establish business contacts with Korea with regard to expanding trade and technical collaborations.

A special group visit is being arranged with the cooperation of leading electricals and electronics associations for the benefit of small and medium scale industrialists, businessmen, technical experts, professionals and executives. The group will visit important commercial centres in Japan, Korea, Taiwan, Hongkong, and Singapore. Visits to leading factories are also being arranged.

Biomedical Engineering Conference

The 8th Annual International Conference of the IEEE Engineering in Medicine and Biology Society will be held at the Worthington Hotel in Fort Worth, Texas from 7th to 10th November, 1986. The conference aims to serve as a focal point for the latest developments involving technology in health care and to bring together the relevant research efforts, the clinical developments and the industrial applications.

This conference is the world's largest meeting in the area of biomedical engineering and computing as reflected by about 500 technical contributions presented in the previous conference in Chicago, by authors from 22 different countries. This year's conference promises to be one of the most exciting technical events covering a wide spectrum of state-of-the-art technologies. Included in the program are also 2-3 sessions on 'health care technology in the third world countries' to be presented by leading experts in the field.

The highlight of the conference will be a special mini-symposium on 'critical and emerging issues in biomedical engineering' aimed to serve as the central nucleus of the technical sessions. The symposium will consist of in-depth coordinated technical tracks with 'diagonal' prognostic tutorials. World leaders will address the tutorial sessions which include advances in rehabilitation engineering, innovations in biomedical engineering, cardiology, communication systems, intelligent devices, artificial organs, biomaterials, etc.

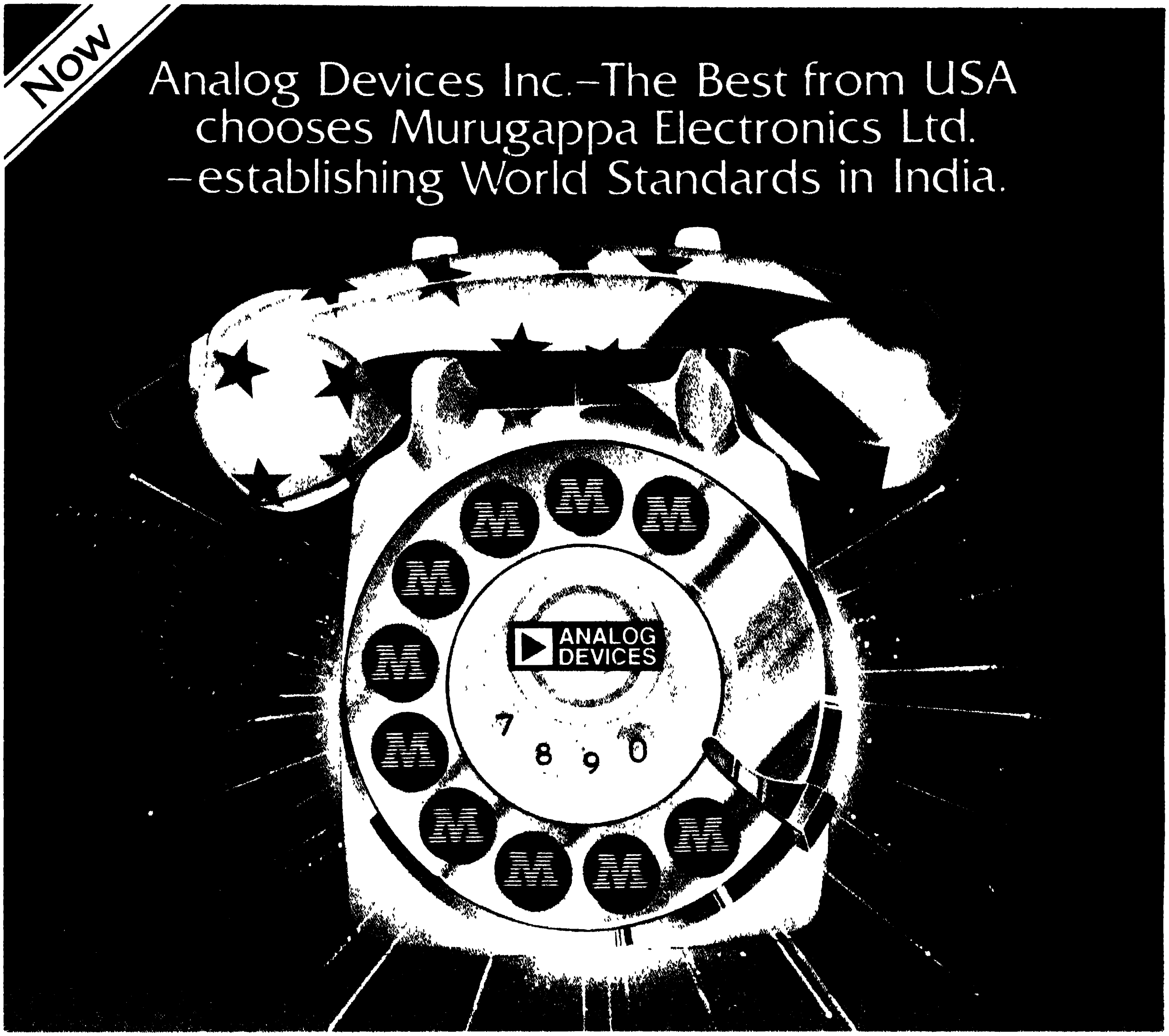
High-Tech Telephones

An unexciting acronym from the field of information technology is the key to a world in which robots on an assembly line will be tuned by engineers in another country, airline tickets will be printed at the user's home and doctors will examine and even treat patients without meeting them.

The term in question is VANS, which stands for value added networks. This rapidly expanding type of service is created by adapting existing communication lines that previously carried only telephone, telex and television.

In the beginning of the 1980s, licensing had been liberalised in Britain to permit a range of VANS, including automatic ticket reservation and issuing, telebanking—using home computer terminal to transfer money from one account to another—and electronic mailboxes which store incoming messages for screen display. In-house information retrieval systems multiplied, eliminating hours of manual searching. For example, extracts from the vast collection of the British Library's—volumes stored on kilometres of shelving—can be flashed on a screen at the touch of a keypad.

Most participants in the world telecommunication industries meet at London agreed there was an exciting future for VANS in a world with 600 million telephones, potentially capable of being linked to on-line information and other interactive services. Many envisaged a world after the turn of the century in which physical operations can be directed through information technology.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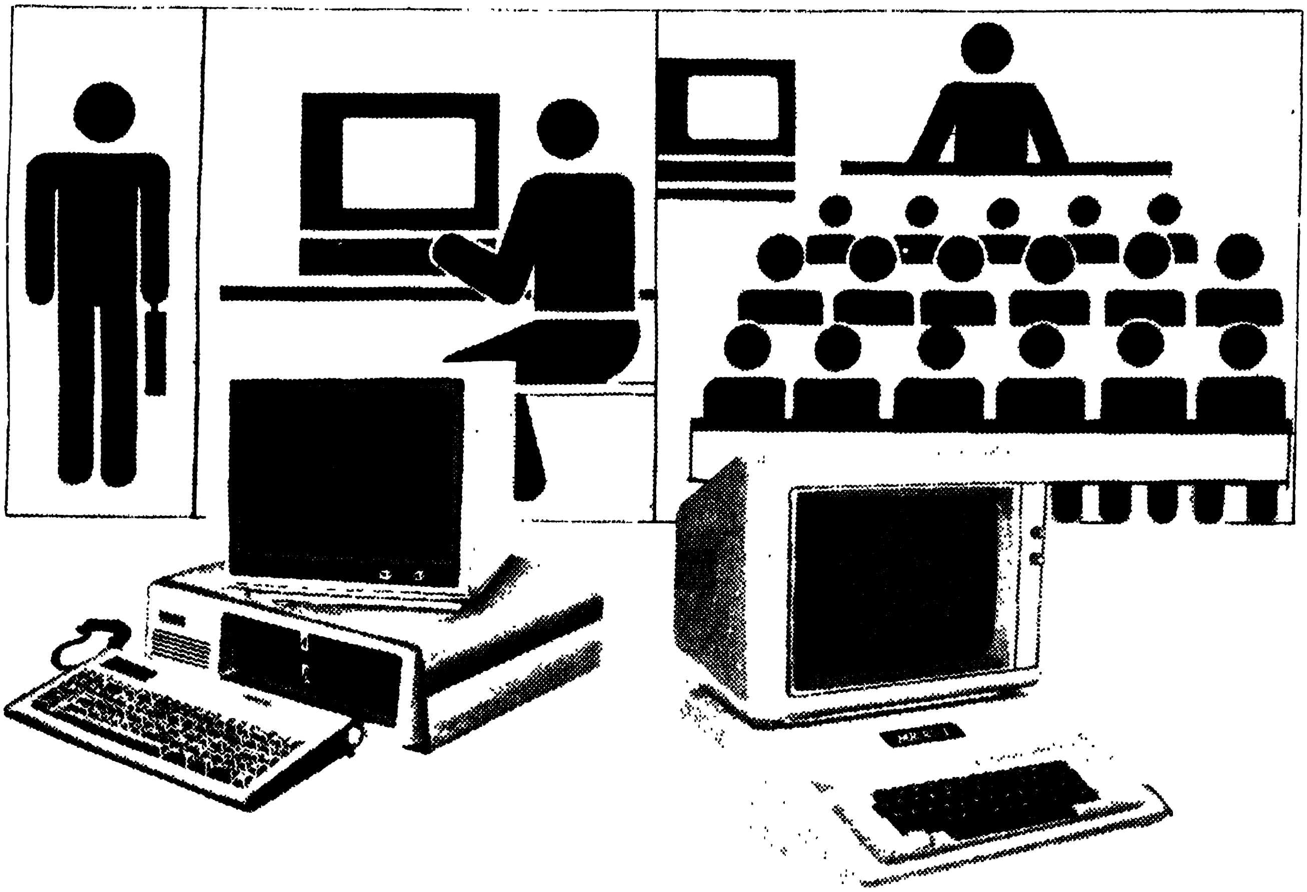

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CMOS Technology: Catching Up

Y.K. Shah

The CMOS (complementary metal oxide semiconductor) technology was always thought of as the ideal technology because of numerous advantages like low power dissipation, high immunity to power-supply noise, symmetric switching characteristics and large supply voltage tolerances.

Despite these obvious advantages, CMOS has rarely been used (till recently) for advanced VLSI microcomputer designs and linear circuits. The reason behind this was the complexity of the CMOS process accounting for a relatively poor price/performance ratio. Owing to this fact, the CMOS found use only in applications that required low power and were neither performance conscious (as in watches and calculators) nor cost conscious (as in military applications).

But now, all of a sudden, all major semiconductor companies have announced advanced CMOS products which could affect the future circuit designs tremendously. A glance at the products announced by Texas, USA will be sufficient to substantiate this.

Texas Instruments has introduced a new series of products known as Lin CMOS which provides the low-power and high-input impedance advantages of CMOS without offset drift and speed problems. Lin CMOS technology is a new processing technology for linear silicon gate CMOS ICs developed exclusively by Texas Instruments. A whole generation of Lin CMOS devices is arriving shortly to provide the power, performance and economy benefits of the new technology to an expanding segment of the linear circuits world such as operation amplifiers, comparators, data acquisition, timers, power supply controllers, line circuits, display drivers, peripheral functions, etc.

And the list may grow indefinitely! It is obvious from the various comparative charts provided by Texas that the above mentioned functions would be smoothly and conveniently performed in a much better manner by Lin CMOS chips, though at a slightly higher cost at the moment. However, the advantages of the changeover will definitely offset the slight increase in cost.

Before going into an in-depth analysis of these wonderful Lin CMOS devices, let us have a cursory glance at the phenomenon resulting in closer gap between the CMOS technology and MOS technology to be used for VLSI fabrications. As a matter of fact, the dominant VLSI technology (NMOS) is rapidly approaching the process complexity of standard CMOS.

Initially, the LSI circuits were made with p-channel MOS transistors which were relatively slow and difficult to interface to normal integrated circuits (TTL) but made high-circuit densities feasible. But soon the NMOS was introduced which provided greater speed (electrons having higher mobility than holes) and TTL compatibility. However, NMOS is more difficult to manufacture than PMOS. Improvement efforts on NMOS brought HMOS by scaling (or shrinking) silicon devices, accomplishing three main advantages, viz, increased speed and density at reduced power.

The improvements in last 10 years in VLSI technology, and the consequent reduction in transistor size at the device level have increased memory density by a factor of 64, speed by a factor of three, and reduced power consumption by a factor of 100. But the scaling cannot continue infinitely because of resolution limitations of the photolithographic equipment used for making the circuits and the breakdown mechanisms within the devices.

In fact, even before these limits are reached, heat dissipation sets in in the NMOS devices. The heat generation increases exponentially with transistors' count. And at densities approaching 150,000 transistors per IC, special cooling measures are required. Evidently, this heat can accelerate failure mechanisms within the silicon, thus reducing the system reliability. To overcome this barrier, low-power devices had to be made and the industry turned to CMOS as a potential alternative.

The CMOS achieves its low-power dissipation through the use of both p-and n-channel transistors (hence the name 'complementary'). In CMOS, there is no dissipation of DC power in either logical state, and AC power occurs only during the relatively short switching period. Since most of the circuitry in the design is active only for 10 to 20 per cent of the time, CMOS achieves a dramatic reduction in power dissipation compared with NMOS which continually dissipates DC power whenever an operating voltage is applied. To understand this difference better, operation of a simple inverter of NMOS and CMOS is considered briefly.

The NMOS inverter uses an n-channel depletion mode transistor as the pull-up device (which drives the output line high) and an n-channel enhancement mode transistor as the pull-down device (which drives the output line low). The pull-up transistor is used as a load; its operation approximates that of a constant current source. The pull-down transistor is used as the switching device. When active, it

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Mr Y K. Shah is additional manager, Computer Systems, Instrumentation Limited, Kota (Rajasthan).

charge the load. MOS loads are primarily capacitive and include the parasitic capacitances of the inverter itself, interconnect capacitances and the thin oxide capacitances of all the gates the inverter is driving.

An important characteristic of the NMOS inverter is that, when the pull-down device is turned on, it not only sinks the current from the capacitive load but also sinks the current supplied by the pull-up load device. This current component from the pull-up device exists even in the quiescent state. As the logic gates spend most of their time in the quiescent state, this quiescent current accounts for up to 90 per cent of the total power dissipated in NMOS VLSI designs; the remaining 10 per cent comprises the switching or dynamic power.

Another important related characteristic of the NMOS inverter is that its output voltage in the low state, VOL, is dependent on the ratio of the impedances of the pull-down and pull-up devices. This ratio affects the noise margin and switching speed and is generally around 4:1. Such a ratio results in a VOL of the order of 0.2 V to 0.3 V. It also causes symmetric switching characteristics, and the fall time of the inverter is significantly faster than its rise time.

The CMOS inverter uses a p-channel enhancement mode transistor as the pull-up device and an n-channel enhancement mode transistor as the pull-down device. Both the pull-up and pull-down transistors are used as switching devices. When the input changes from low to high, the p-channel device shuts off and the n-channel transistor discharges the load. Conversely, when the input changes from high to low, the n-channel device shuts off and the p-channel transistor charges the load. In this case, most of the current from CMOS inverter is used to charge or discharge the load. A very small component of current does not flow through the load. This is due to the fact that both the p-channel and n-channel transistors are on for a short period of time during the input voltage transistion. This current component is typically less than 10 per cent of the total inverter current, although this depends to a great extent on the rise and fall times of the input signal.

Comparing the two inverters (NMOS and CMOS) in the light of the above discussion, it is clear that with no quiescent-power component, a CMOS inverter's dynamic power dissipation represents only a small fraction of an equivalent NMOS inverter's power dissipation. Also, the CMOS inverter is a 'ratioless' design, having only one transistor active after an input transistion. This lets VOL go all the way to ground potential, resulting in better noise tolerance. It is also simpler to design CMOS circuits with outputs having equal rise and fall times. While this is important in some circuits, it is generally not taken advantage of in VLSI designs because it requires greater chip area.

Both the NMOS and CMOS technologies with similar transistor dimensions and gate oxides have identical gate delays. As far as speed power consumption characteristics are concerned, there is tremendous power advantage in using CMOS for high performance VLSI designs. While the CMOS technology enjoys significant electrical advantages over NMOS, it is rather expensive. This is because of the larger number of process steps needed to fabricate a CMOS device and the need for a larger die owing to its lower gate density.

There are four major CMOS technologies in application at present. They are:

(a) p-well bulk;
(b) n-well bulk;
(c) twin tub bulk; and
(d) silicon-on-sapphire (SOS).

Out of these, the highest performing CMOS technology is SOS. In this process, the silicon islands are grown on an insulating sapphire substrate and then n-channel or p-channel transistors are built on the islands. Thus there is significant reduction of parasitic capacitance and, obviously, the performance increases greatly. The SOS technology also offers good gate density because no parasitic bipolar transistors are around to cause a phenomenon called 'latch-up'. But the SOS devices are difficult to manufacture and expensive, largely due to the fact that unused sapphire wafers cost approximately 10 times more than bulk silicon wafers.

The CMOS suffers a cost penalty of about 20 per cent generally due to process differences, but more significantly because of die size. While the processing steps have a linear relationship with cost, die size has an exponential relationship. Actually, CMOS dies are larger than equivalent NMOS designs even when aggressive transistor scaling is employed. There are three main factors contributing to the larger die size—the area used in trying to prevent latch-up, CMOS logic gate structure and static design techniques.

The CMOS can also use dynamic circuitry, especially to increase the ratio of n-channel transistors to p-channel transistors. Since the static CMOS designs have a 1:1 ratio of n-channel to p-channel transistors, increasing this ratio will have the effect of giving CMOS a higher gate density. But the minimum operating-frequency characteristic of dynamic circuitry often conflicts the CMOS potential for absolutely minimising power. Therefore, while true static CMOS design does give the lowest possible power consumption by allowing the device to operate at frequencies all the way to DC, dynamic CMOS designs—being more dense and resulting in smaller die sizes—tend to be more cost-effective. These two trends are developing at considerable rate in the use of CMOS for VLSI microcomputer design.

CMOS is the technology of choice of VLSI microcomputer designs mainly due to two reasons. One is its cost-effective solution to the power-density problem and the other is the reduced supply voltage. Noise tolerance is also better in CMOS at reduced supply voltage than NMOS. CMOS has made, and is continuing to make, major strides in cost advantages relative to NMOS. The designers of the next generation of 16- and 32-bit microprocessors are choosing CMOS. Here the aim is not to operate at the lowest discharges the load and when inactive it lets the pull-up possible power level but rather to keep the operating power under a maximum level for cooler junction temperatures, higher performance levels and the ability to use standard low-cost packages. In these designs extensive use is made of dynamic logic. The ratio of n-channel transistors to p-channel transistors is often as high as 3:1.

Designers of 4- and 8-bit single-chip microcomputers are choosing CMOS to accommodate a host of new portable, hand-held, and ultra-low-power applications. Here the aim is to minimise the operating power levels, consistent with the performance required by the application. In the simpler microcomputers, true CMOS static logic is used; their simpler structure allowing a still smaller die size, while the low-performance applications are appropriate for allowing low operating frequencies. On the other hand, the more complex, higher performance, single-chip VLSI components make maximum use of static logic but are forced into dynamic logic for large arrays to keep the die cost down.

Intel's 80C51 is an interesting example of how the static logic versus dynamic logic trade-off is made in an actual product design. This is an 8-bit, single-chip microcomputer with 4k bytes of ROM, 128 bytes of RAM, two 16-bit counter/timers, multilevel interrupt control, 32 I/O pins, full duplex UART, clock circuits and on-chip oscillator.

The 80C51, CMOS version of the 8051, is targeted at a number of applications that require both high performance and low power consumption. In applications like telephony, automotive control, industrial control and portable instrumentation, the 80C51 operates at or near its maximum speed, even if only for short intervals. For instance, in most of the real time applications, the requirement for external interrupt response time is of less than 100μs; more demanding applications require better than 10μs response time. Though the response must be quick and the interrupt routine executed quickly, the processor spends a significant part of its time almost doing nothing.

It is feasible to specify the minimum operating frequency once we know the performance requirements of the applications. In the case of 80C51, a hybrid static/dynamic design was proposed which allowed a minimum die size and included various modes of operation to minimise power consumption. In the first step, the only areas of the design that were made dynamic were the very large ROM and control arrays. These arrays contained almost 50,000 transistors and constituted a major portion of the die. By making them dynamic, an area saving of approximately 50 per cent could be affected. In the second step, the processor, all the peripheral functions, the RAM and the I/O ports were made static. This type of architecture allowed two modes of operation, other than the normal operating mode. These two modes were termed as power down mode and idle mode.

Since in many applications the processor does nothing more than wait for an event to happen, in the idle mode, the major clocks of the device are stopped and only smaller, ancillary clocks operate to drive the peripheral counter/timers, external interrupt control and the serial channel. When one of the peripherals generates an interrupt, the processor clocks are restarted and instruction execution resumes in the interrupt service routine. This idle mode reduces power consumption by almost an order of magnitude.

In the power down mode, all the clocks inside the device are shut off and only the internal 128 bytes of RAM are 'kept alive'. In this case, only a minute amount of current is consumed due to p-n junction leakage. Static logic was designed in the peripheral sections in order to support this mode because no clocks are available to refresh dynamic logic.

In both the idle mode and power down mode, special provisions are made for the dynamic circuits in the ROM and control areas to enter a pseudo-static condition that prevents any extraneous power consumption due to voltage drift on capacitive storage modes. The 80C51 designed in Intel's HMOS-derived n-well process called CMOS, is less than 10 per cent larger than the NMOS design and consumes only 15 per cent of the normal operating power. However, more significant power savings are possible by operating the 80C51 at lower frequencies or by using the idle mode.

Taking some typical examples, we shall now have an in depth view of the Lin CMOS. The low-power analogue or 'linear' ICs are conventionally fabricated from metal-gate CMOS—a high-capacitance process that yields very low-power operation, but only by sacrificing stability and speed. However, Texas Instruments has now come out with a new development using silicon-gate CMOS process with self-aligned gates which exhibit only 1/7th the capacitance of their metal-gate equivalents. Also, the unavoidable threshold voltage drifts caused by the movement of sodium ions within metal-gate IC transistor structures have been virtually eliminated.

As a matter of fact, Texas has replaced the metal-gates with phosphorous doped polysilicon. This has resulted in the reduction of gate thresholds with changes in time, temperature and gate voltage from millivolts to a few microvolts. This, dubbed CMOS (for linear CMOS), also yields analogue ICs with bandwidths two to three times greater than metal-gate fabricated devices. This has been possible because of enhanced n-channel carrier mobility and lowered capacitance values. By placing NMOS transistors in p-type substrates and PMOS counter parts in n-wells, Texas enhanced the speed of the NMOS transistors. Putting n-channel devices in the substrate gives their carriers almost four times greater mobility over p-channel devices in the same substrate.

In contrast, the p-well approach of metal-gate CMOS results in n-channel mobility only 1.5 times greater than p-channel transistors in the same device. Because the gates in

Lin CMOS processing are formed during the same processing step that forms the source and drain areas, all three elements are self-aligned, i.e., no overlap is needed to ensure alignment as in the case of metal-gate. It is to be noticed that although metal-gate CMOS involves fewer processing steps (eight steps, nine masks), Lin CMOS has only three critical steps to metal-gate's five. Lin CMOS requires 13 processing steps and 12 masks, but reduction in the critical alignment of diffusion, gate oxide, and gate metallisation sharply cuts the cost of fabrication.

Lin CMOS devices were first used in operational amplifiers. While selecting an operational amplifier, a circuit designer is frequently forced to choose among a host of desirable features, extremely high-input impedance, low and stable input offset voltage, single-supply operation, programmable power levels and AC performance. Customarily, superior AC performance is achieved only through bipolar design whereas high-input impedance and low-power, low-voltage operation fall into the realm of CMOS FETs. The majority of operational amplifiers that do provide these performance features are usually constructed as expensive hybrid packages. Delivering all of these attributes on one low-cost CMOS chip - as the TLC-271 and TLC-251 - is a break-through. There is only one major difference between these two. While TLC-251 is specified to operate from a single-supply voltage as low as 1V, the TLC-271 needs at least 4V between its positive and negative power supply pins. However, both can operate from power supplies up to 16V.

Although several other CMOS operational amplifiers match these chips' high-input impedance (10^{12} ohm) and low-input bias current (1 p.amp. at room temperature), none guarantees against the input offset voltage drift. These operational amplifiers have low offset (typically less than 2 mV), high common-mode range and high common-mode rejection ratio of 88 dB. All are particularly insensitive to gate voltage stresses. Furthermore, these parameters remain constant over long periods of time, virtually eliminating the need for chopper stabilisation techniques which provide the ultimate in DC stability. As a matter of fact, the offset voltage remains stable to within $0.1\mu V$ per month at 55°C.

It is apparent that these two chips would be the best choice for replacing currently used operational amplifiers like OP-07, F-714 or BIFETs OAs. Both TLC-251 and 271 are available in a standard 8-pin DIP and in an SO (small outline) package. A selection and interchangeability guide brochure is available with Texas Instruments which can give a more comprehensive picture to the users of operational amplifiers.

Besides operational amplifiers, the next generation Lin CMOS devices which are bound to find immense popularity among users, would be timers and comparators, of course, to be followed by many more, as listed earlier. It can thus be easily visualised that CMOS technology is best described as the future technology and all future circuit designs would be exclusively based on one variation or the other of CMOS technology. □

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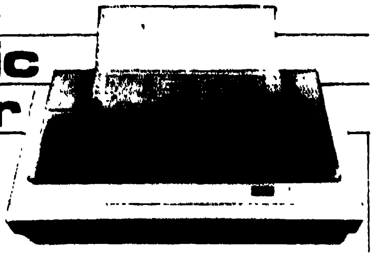

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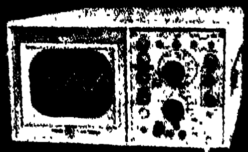

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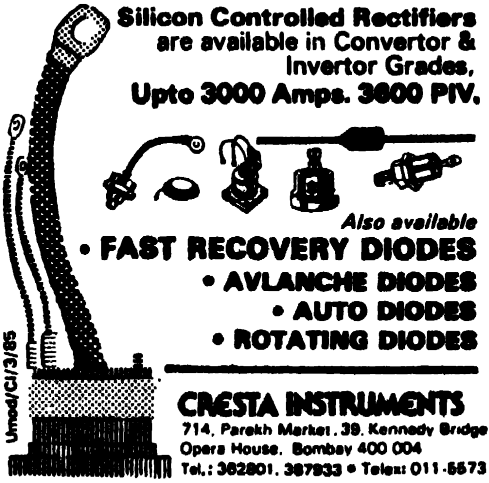

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Microprocessor Control of a Diesel Generator

C.S. Prasanna Kumar

Conventional DG (diesel generator) sets have a panel board comprising contactors, relays, timers, meters, battery charging system etc. Broadly, we can divide this panel board into three parts:

1. Contactor console
2. Metering console
3. Control console

The third part, viz, control console is discussed here in detail.

The control console comprises electromagnetic relays, timers etc. The DG sets are conventionally used as follows:

1. Manually operated single DG set
2. Single DG set operated as AMF set
3. Parallel DG sets, each switching on one after another.

Application of microprocessors: a case study

A 110 kVA DG set with an AMF panel comprising contactors, metering and the controls is selected. The controls are electromagnetic relays. The normal AMF operation of the DG set is shown in Fig. 1.

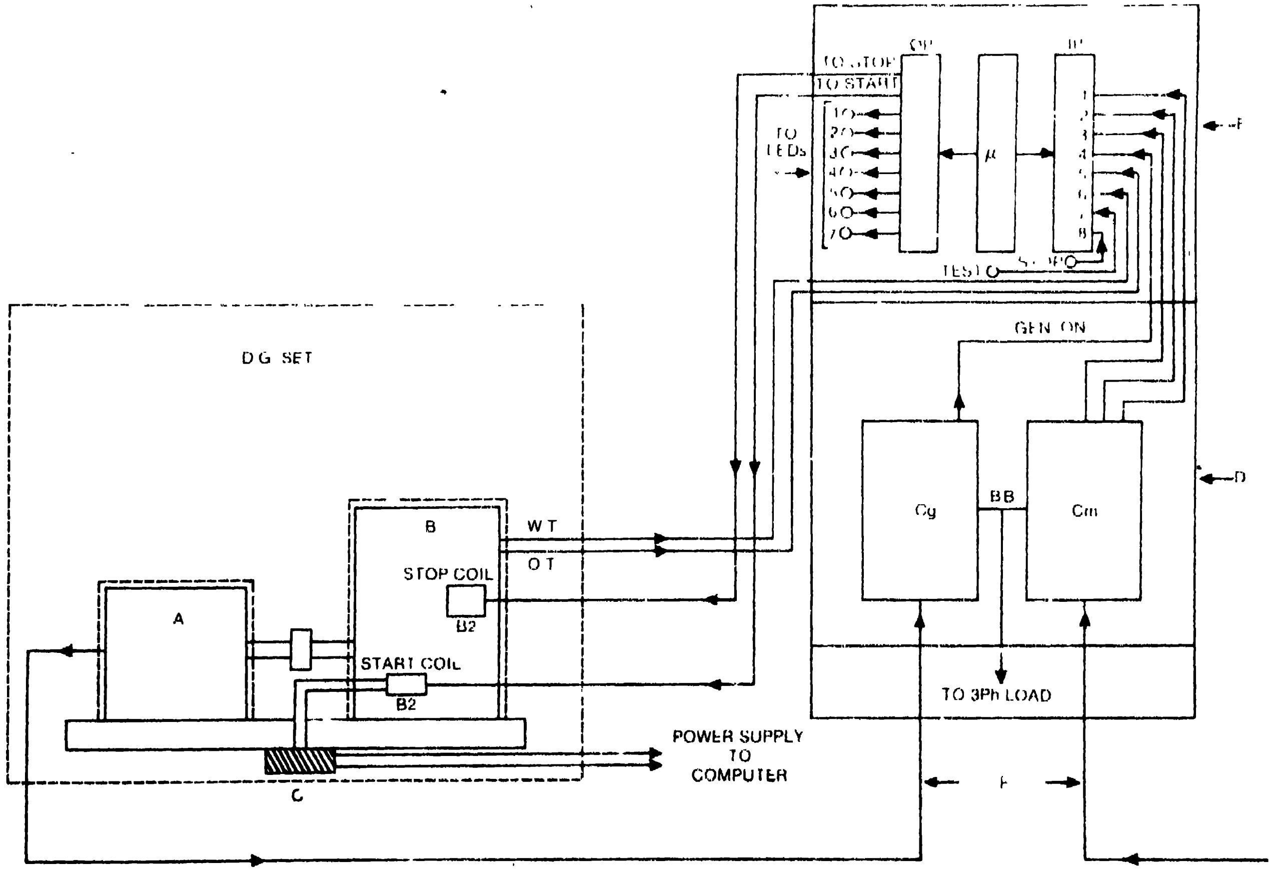

Fig. 1: Normal AMF operation of DG set.

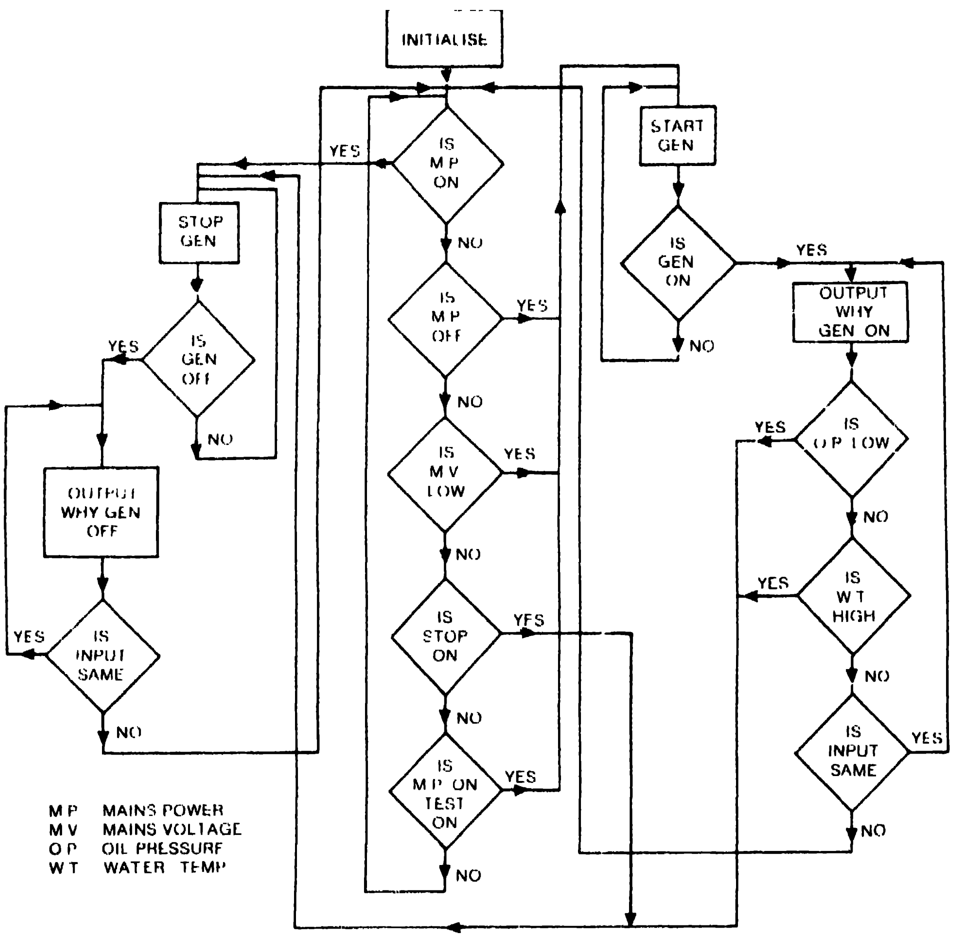

Fig. 2: Flow chart showing the microprocessor control of a diesel generator.

The experimental set-up for microprocessor control is shown in Fig. 2. Here,an Euro STD bus standard PCB glass epoxy card with 8085 chip, programmable peripheral interfaces chips (8255) ROM, RAM, etc are used. The program resides in a 2k EPROM (2716). Input card is a PCB glass epoxy card with optoisolators, buffers etc. Output card is similar but has solidstate relays to which the external system is interfaced.

The set of cards along with the power supply unit is housed in a standard 48 cm (19-inch) Al card cage. The construction is modular in nature. 5V DC supply required for the system is obtained from the batteries.

System functioning

The input information to the microprocessor is digital. Optoisolators in the input avoid interference. The input is latched on through a buffer to the STD bus. The microcomputer card is connected to the STD bus.

The input information goes to the microprocessor which analyses the input information and gives out the output to the STD bus. The output information is latched through the buffers and is available for operation of the solidstate relays.

A logic '1' closes the relay and logic '0' does not operate the relay. For example, to start the generator a solidstate relay connected to the start coil gets the logic '1' as input. Similarly, to stop the generator, a logic '0' signal appears at a particular solidstate relay to operate the 'stop coil'. All the output LEDs are connected to solidstate relays.

Whenever an input status signal appears on the STD bus, it does not operate the output card because it is tri-stated. Similarly, whenever the microprocessor gives out an output condition, it triggers only the output card and the input card is tri-stated.

Result

Upon operating 110 kVA DG set using a microprocessor and an AMF operation, it is found that:

All the conventional time delays for start, stop etc are easily incorporated.

Any variation of time delay is easily done by altering the program.

Comparisons

Microprocessor control of DG is very convenient because the size is very much reduced thus saving space. The system is also superior and reliable being microcomputer controlled.

The cost of the complete panel board including contactors, control and meters is lesser than the cost of conventional panel boards of some leading manufacturers.

Extendability

The idea can be extended to control two or three DG sets operating independently. The cost of this will not be very much more. In fact a multi-generator control system can easily operate on a single set without any change.

For the parallel operation of similar DG sets, the following criteria are essential:

1. Equal system voltage
2. Equal system frequency
3. Same phase sequence

The first two conditions are presently attained manually. Nowadays, digital phase comparators are available which can be housed in the controller for purposes of parallel operation.

Single low-RPM DG sets have other features like crankcase heaters, fuel pumps, cooling towers, compressed air start etc. Microcomputer system can be used for such DG sets also.

Conclusion

Thus it is seen that microprocessor control of diesel generator is reliable and has a tremendous techno-economic viability.

□

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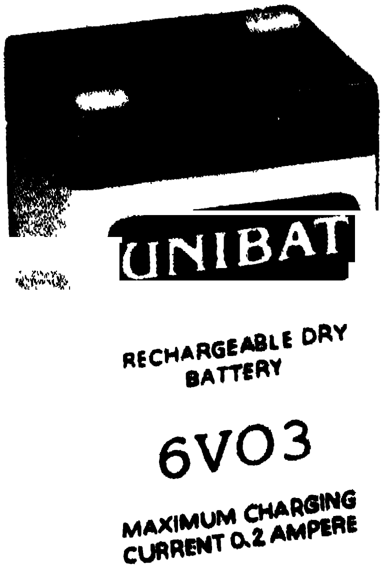

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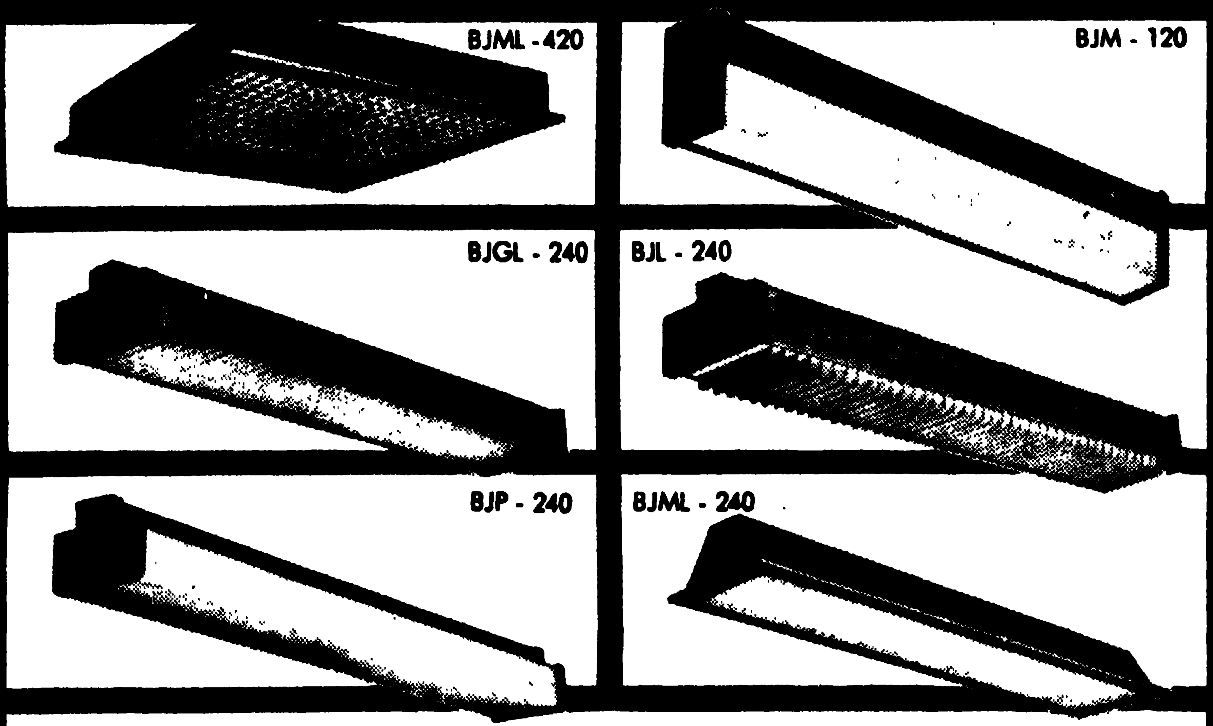

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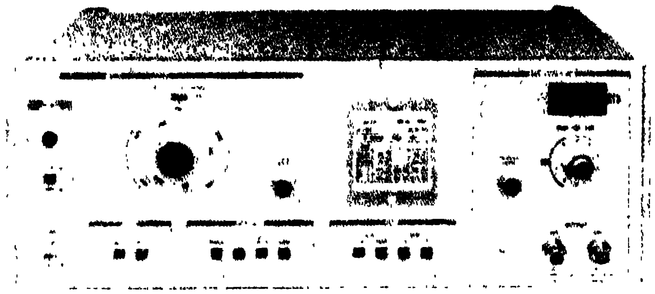

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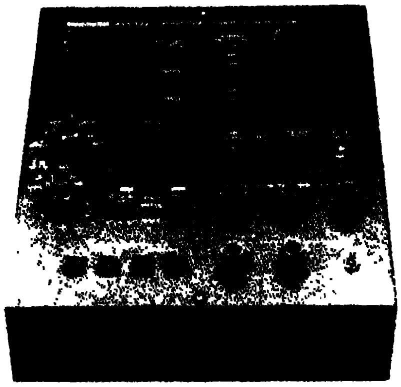

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Are Robots Coming?

Dr N. Vanvari

Many of us have heard about robots being employed to retrieve the 'black boxes'—the CVR (cockpit voice recorder) and the DFDR (digital flight data recorder)—of the ill-fated Air India flight, 'Kanishka', from the depths of the Atlantic Ocean in July '85.

After extensive search operations were launched and called off by navy vessels of various countries, robots were called upon to fathom the ocean. And sure enough, it was the probing robot arm of the SCARAB that retrieved the 'black boxes' from nearly 20,000 metres below sea level! This amply indicates the role robots are playing now and will play in future, in carrying out humanely impossible tasks.

But before attempting to answer the question, viz, are robots coming, one must have a grasp of what a robot is, how it works, and the advantages and problems associated with its usage.

The word robot was derived from the Czechoslovakian 'robota', meaning, servitude and drudgery. It was popularised in 1920 by the Czech playwright Karel Capek in his play 'Rossum's Universal Roboters', in which humans played as robots.

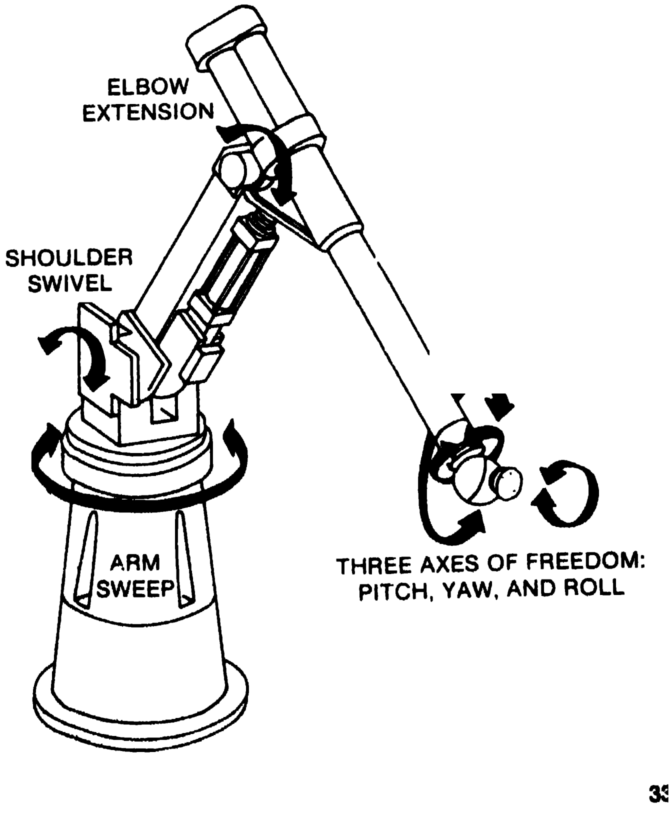
The most widely accepted definition of an industrial robot is that it is a programmable manipulator that can perform useful work automatically without human assistance. CAM-I (Computer Aided Manufacturing International), a manufacturer-user group, defines the industrial robot as "a device that performs functions ordinarily ascribed to human beings, or operates with what appears to be almost human intelligence."

Types of robots

These definitions closely fit modern robots. These manipulators can generally be divided into two classes: sequenced (fixed sequence or variable sequence) and computer-controlled robots. The former employ arms with limited axes. The arms move from point to point. Each of the discrete movements must be recorded in the robot' memory in a sequence. Limited sequence robots includ electrically and pneumatically activated arms and are generally less costly than the more sophisticated computer-controlled types. Some can be purchased for as littl as $ 5000.

Computer-controlled robots usually employ servo controlled arms with five or six axes of articulations and operate from either electric or hydraulic power. They can be programmed to operate over an infinite number of points that describe the sphere of operation of the robot arms. Such a robot can be taught by an operator to memorise its paths of work in any sequence. They cost from $ 40,000 to 60,000 and more.

An advanced robot from Cincinnati Milacron is the T^3R (see figure) which has the same base, shoulder, and uppe arm as Milacron's T^3 robot, but incorporates a new wrist design. The wrist on the T^3R^3 is shaped like a sphere, with a diameter of about 20 cm, and consists of three roll axes coincident at a single point. The two roll axes that are



Dr N. Vanvari is deputy general manager, Haryana State Electronics Development Corporation Ltd.

closest to the robot forearm, working in combination, provide 230 degrees of yaw (side to side) motion. The third axis (farthest from the forearm) provides continuous roll for rotation of the tool.

The wrist contains three concentric shafts that drive the axis and are powered by hydraulic motors mounted at the elbow of the robot's arm. The light weight of the wrist provides low inertia for each wrist axis and the remote drive system provides enough stiffness for good servo control. Also, each axis has its own feedback device consisting of a resolver and tachometer for precise positioning. The standard positioning accuracy of the robot is ±0.051 cm.

The types of robot which are likely to dominate the Japanese market are identified as NC (numerically controlled) robots, fixed sequence robots and playback robots. Other types of robots with strong growth rates will be intelligent robots and variable sequence robots.

Applications of robots

One of the oldest industrial robot applications is spray painting. Robot makers like the Binks Manufacturing Co., Trallfa of Norway (distributed in the US through the Devilbiss Co.) and Nordson Corpn, USA, make robots specifically for painting. Such robots relieve human spray painters of an unhealthy task, produce more uniform paint coatings and minimise waste of paint. The largest robot spray painting applications are in the automotive industry. But it is in assembling of components where industrial robots are showing the greatest growth. The trend has been towards small components (typically weighing less than 2.5 kg) in close confinement.

Since robots can be used in many ways, it is conceivable that they may be used to handle explosives, dangerous and harmful materials, high-temperature or low-temperature objects, radioactive materials and so on, under a controlled environment. But since the dangers inherent in the use of robots change drastically with the form and mode of the work and other such factors, robots constitute an important safety problem, requiring adequate study before they are put to such applications.

The applications of robots are, however, ever increasing. This is reflected by the fact that Sumitomo Electric Co. of Japan has successfully developed a robot which can play keyboard type musical instruments. It weighs 90 kg, is 180 cm high and has the capability of seeing, hearing and speaking. It can operate electronic organs with its hands and feet and can read scores and play likewise.

The human-shaped robot is equipped with arms and legs, has 50 joints and its fingers can work like those of a musician on the keyboard. The robot can strike keys at a high rate of 15 strokes per second and play a variety of music.

The machine is controlled by a system consisting of seventeen 16-bit and fifty 8-bit microcomputers connected to one another by fibreoptic data links with a maximum transmission capacity of 32M bits per second.

The designers developed special engineering techniques to control its complex activities, sophisticated fibreoptic data transmission methods to permit high-speed action and new structural materials to make it light. The machine can recognise registered vocal commands from an operator and respond in a synthesised voice consisting of independent syllables combined into smoothly pronounced words and sentences that sound natural with controlled rhythm.

Robot sensing systems

There is constant debate about whether a robot should have tactile sensing or vision sensing, or both. Vision and tactile sensing serve specific purposes. Vision is good for parts indentification and acquisition, whereas tactile techniques are better for parts insertion. So robots can use both types of sensing.

With the moves to increase automation of factories, development of robots, especially intelligent robots, has drawn keen interest from industry. Control systems and mechanical technologies have led to advanced robot capabilities. But for taking robots to a more advanced step in which they can move on the basis of the work to be done and the environment of the workplace, rather than simply following preprogrammed instructions, sensors will be indispensable. Visual sensors are among the most important for more advanced robots.

With visual sensors, recognition decisions are performed in a preprocessing unit that draws the essential information from image data obtained by using a camera to form the basis for a decision within predetermined parameters. On the basis of these parameters, the main processor makes the final determination and the controller drives the movement of the system.

Visual recognition systems takeover from humans in three basic functions, viz, discrimination, position and orientation detection, and inspection.

A useful application of robot visual discrimination technology is that of pin-picking and recognising objects one by one. The separation of objects in an orderly manner, clearly divided visually from large to small, makes it possible to use a standard robot visual system. However, there are problems when objects are jumbled together or when they adjoin or overlap each other. This is an interesting field for future research.

But, when metal bars are piled indiscriminately, it is possible for a visual system to distinguish them by taking advantage of the fact that their surfaces shine if light is flashed at the edges, giving off a brighter image. Then, discrimination is done by analysing time pattern of reflection. Discrimination by this method is nearing practical application.

For inspections that do not involve precise eye-to-hand coordination, much of the current vision technology is usable. Colour vision can spot a fruit that's ripe for picking, while infrared sensors are good at detecting potential sources of disease before a crop becomes infected.

A number of improvements in vision and light-sensing devices for robotic equipment may increase their range of application. High resolution solidstate imaging devices have reduced the cost of getting scene information into digital form; and falling prices of computing power and main memory have aided vision input just as they have aided visual display.

Examples are the MVS 100 vision system of Perception Inc., Farmington Hills, Michigan, which can recognise parts on an assembly line and initiate different operations for each part; the RV 600 of Automatix Inc., Burlington, USA, which can track and inspect welding seams produced by a robot welder; and a printed-circuit board inspection system based on pipelined image processing architecture developed by the Environmental Research Institute of Michigan, Ann Arbor,and the three dimensional imaging system using multiple cameras for parts inspection and quality control developed by the General Motors Corporation.

Thus far, however, vision systems still fall short of human abilities (function of human eyesight) by several orders of magnitude.

Installation, preparation and adjustment

Most of the robots have a centre of gravity that is not at the centre of their body and which changes according to the position of their arms. These robots cannot stand upright until they are anchored on to a platform with bolts. Robots are very unstable during transport and are very difficult to handle if the arms are not locked. These stability factors should be considered whenever industrial robots are to be moved for installation.

The adjustment and positioning of the limit switch, shock absorber, brake and other elements to instal a robot in its working position sometimes requires people to work in high places. This kind of above-the-floor workplace to set a robot into position is not frequently seen in factories using conventional machines and can therefore be considered peculiar to working with robots.

Operations to change the hand-grasping element or connecting the robot to form a system with other machines, or to instal a guard fence may not seem to be much of a problem when they are performed with the power supply to the robot turned off. Whereas, operations such as gain adjustment, offset regulation or auxiliary circuit regulation to make the fullest use of robots, must be carried out with power supply on.

When a work sequence performed by a robot is to be revised, the pre-recorded cassette tape must be re-recorded or replaced after the new work sequence has been programmed. This work includes confirmation of whether the new program called for has actually been set.

Programming is the work of preparing in advance, the sequence of operations to be performed by the robot. Various systems are available: (i) programming by numerical control language, (ii) pinboard method, (iii) combination of potentiometer and sequencer, (iv) teaching box, and (v) direct teaching by actually moving an arm of the robot. These methods involve control of movements of the very powerful and potentially dangerous arms. Specially, the teaching box method of robot programming is a job involving a close human-robot relationship, in the sense that the robot is taught its work by numerous pushbuttons operated by a human. This teaching work poses peculiar problems concerning the safety of the workers.

Supervision and testing the robot's performance, involving the 'check' and other functions, is conducted at low speed, or with no work load, or with no electric current flowing in the welding wire in arc welding robots, because it is impossible to fully test the programmed robot operations by simply switching them to automatic operation mode. Test sequences involve correction of errors and regulation of electric current or hydraulic pressure. A close human-machine relationship is formed in this test operation work in the sense that the eyes of the operator must be keen to determine with accuracy when the robot is moving at a steady speed.

Before a robot can be used, various set-up operations must be performed: turning on the power supply and the oil pressure pump and manoeuvering the robot arm back to its starting position. Then, the automatic sequences to check the oil pressure, oil temperature, abnormal start and other steps related to the initial operation of the robot can be checked to determine that the robot is in the condition of 'preparations completed'.

The robot is then ready to be switched over to 'automatic' operation and started. When performing these steps, it is important to confirm with certainty that there is no dangerous condition within the operating zone of the robot, as past cases of accidents have clearly demonstrated that a careless or haphazard approach to the set-up procedures is an invitation to disaster.

Protective measures

All kinds of accident-prevention measures should be taken. Among the physical devices and equipment that should be installed are safety fences, safety plugs and mechanical brakes. Sensors to detect the presence of human workers such as photoelectric, electrostatic, ultrasonic, laser and visual monitor sensors, as well as machine malfunction detectors, should also be employed. The construction and function of each of these instruments need more research. Considerably more engineering reviews need to be done to design adequate safety measures into manufacturing facilities where industrial robots are used in large systems to form wholly automated assembly lines.

It is important to thoroughly educate operators, programmers, maintenance and repair engineers as well as part-time workers, on appropriate safety precautions such as guiding them to be away from the danger zones of robots.

Reliability of industrial robots

Failures of the electrical circuits, including the microcomputer, account for the largest number of robot breakdowns, and malfunctioning of jigs and other instruments account for next largest share of robot trouble. Runaway, an unreproducible erroneous action, caused by short-circuits, noise or similar interference, at 11.1 per cent, is by no means a small portion of the total robot trouble statistics.

The mean time between failures (MTBF) is rather high: 75 per cent of robots have an MTBF of 1000 hours or less and those with an MTBF of 100 hours or less account for 28 per cent.

Some robot manufacturers claim that robot reliability has been greatly improved lately. But even with improvement, the best MTBF achieved has been 2500 hours. When robots are incorporated into systems with other machines, they inevitably become machines with a considerably higher incidence of troubles. Under such circumstances, it should be fully recognised that robots have not yet attained adequate reliability.

Market trends in robotics

According to a study, the utilisation of industrial robots was generated by the oil embargo of 1973. With the necessity to save energy as the background, the production trend has been changing from mass production to small quantity output of a variety of industrial products. Consequently, the totally automated factory, equipped with a variety of robots, has become a reality.

Robot sales in US totalled $ 234.9 million in the first nine months of 1984, surpassing the $ 194.4 million in sales tallied for all of 1983, according to the Robotic Industries Association.

The European market for industrial robots will reach $ 572 million by 1986, as high labour costs, declining productivity and fierce international competition increasingly pressurise companies to automate. Although the robot 'boom' that has occurred in the United States has not reached Europe, the market is rapidly gaining momentum.

The increasing abilities and declining costs of robots make it a particularly attractive investment, and the European market for robots is attracting capital and new competition. Over the next five years. the market is expected to grow at compound annual rate of 58 per cent.

The highly labour-intensive assembly application will exhibit the most dramatic growth through 1986, at a compound annual rate of 80 per cent. Assembly work is ideally suited for robots and this application may come to be the dominant sector of the European robotics market, in terms of units installed. With high unemployment rates, however, job security has become a major union issue and union resistance to robots—especially in assembly tasks—is likely to increase.

Health and safety regulations also play a key role in market growth. Although there is no uniform approach among countries, most are under increasing pressure to improve working conditions, fuelling the growth of robot use in applications that are hazardous or unpleasant for workers.

Robots are coming

Robotics is already an important part of the overall factory automation, particularly in Japan and in automobile production world-wide. But the greatest growth in this field is yet to come. At present, the US is far behind the rest of the world in installed robots. For example, there are about 12,500 robots installed in Europe, 140,000 in Japan, but only about 8000 to 9000 in the US. According to some predictions Japan is likely to have nearly one million robots by the year 2000.

USA has now joined the race and is introducing robots in the agricultural field. Robots checking crop growth, harvesting fruit, planting tissue-cultured seedlings, fumigating, cultivating, or milking will soon become a familiar sight in the US.

Robots are proliferating in heavier industries, as well as other fields including military applications. Artificial-intelligence-based military and paramilitary robots for applications ranging from battlefield service to sentary duty may pass $ 500 million mark, according to the Internation Resource Development Inc., USA.

The benefits of robotics are now well established: increased quality, higher productivity, and high reliability of products manufactured with the help of robots. But considerable work still lies ahead in robotics, specially in software development and support functions. Eventually, robots will be linked directly with networks linking various computers. New sensors for vision and tactile feedback are being incorporated in order to make true assembly robots feasible.

Artificial intelligence techniques are also being coupled with robots for taking into account unexpected events such as tool breakage or a robot gripper dropping a part. Simply sequenced robot motions may cause disastrous results unless such possibilities are taken into account.

However, marriage of robotics with microprocessors and other semiconductor devices has already taken place and is leading to the development of 'mechatronics' techniques. With application of these techniques, robot is no more "a passive, stupid machine that deteriorates rapidly under load" and, therefore, will clearly play a greater role in future automation, space exploration and 'star-wars'.

Now, the question that remains to be answered is "will robots come to India, a country having labour-oriented economy?" Answer is probably "yes". But, robotics will be useful for India if it is kept confined to areas where the going is hazardous for human worker. □

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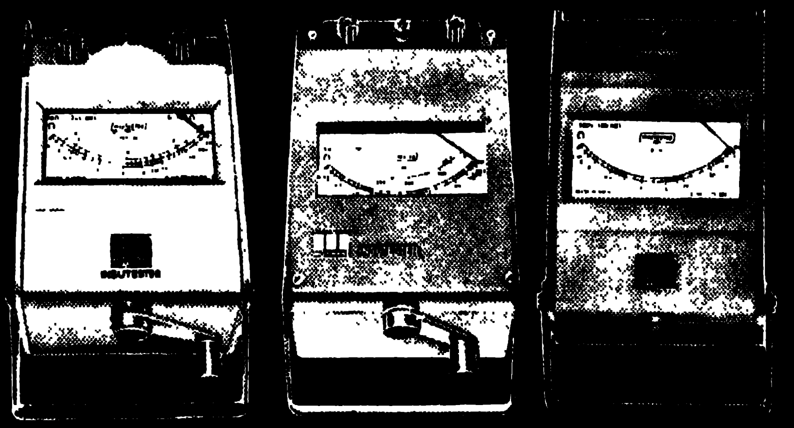

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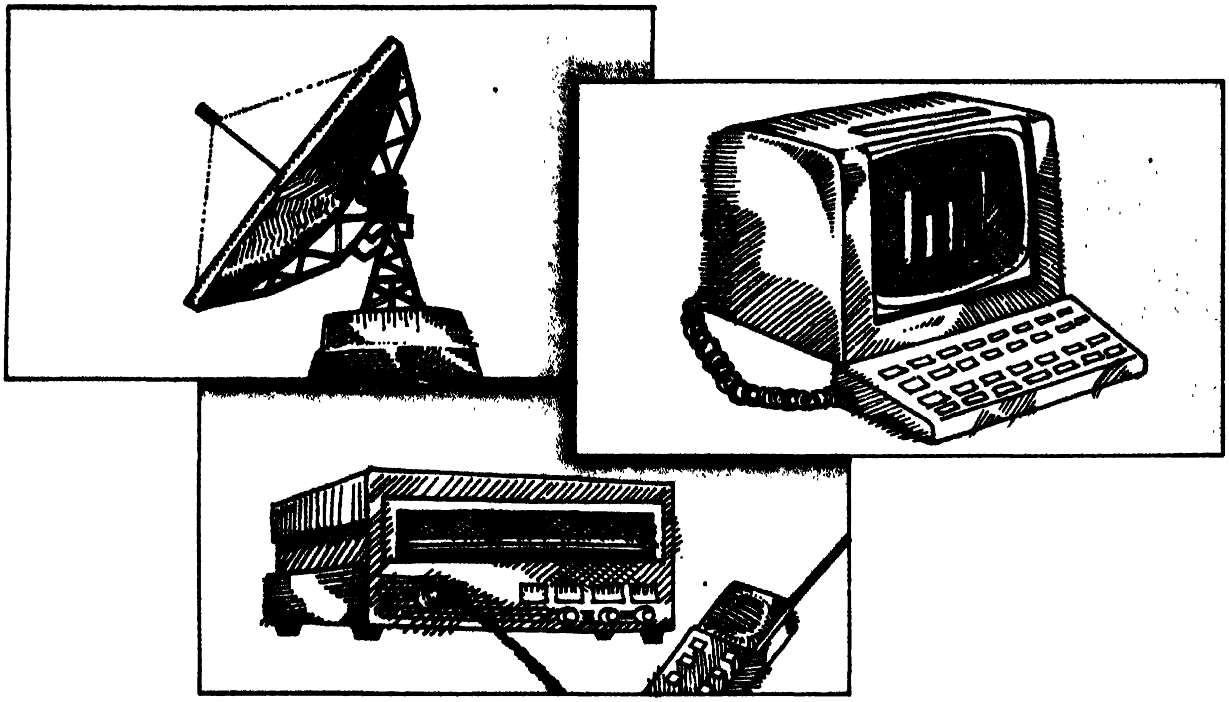

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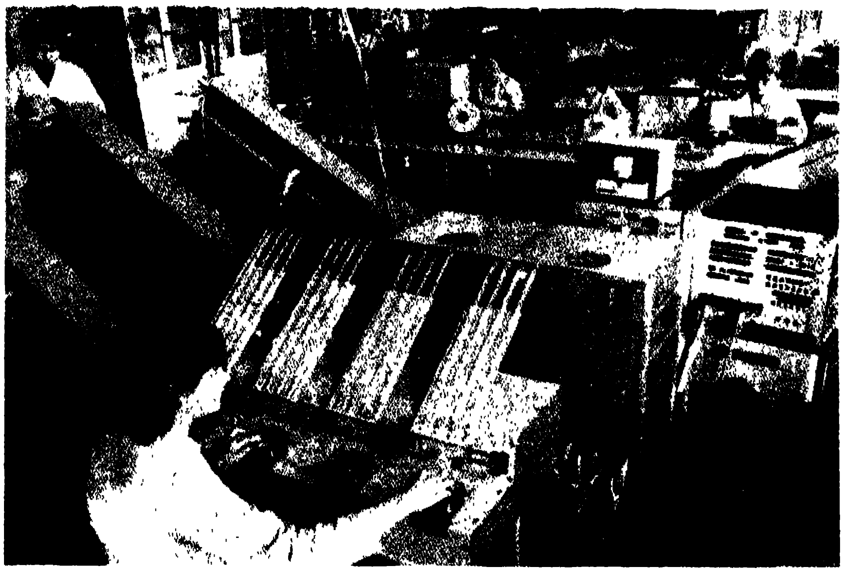
Czechoslovakia: The Electronics Boom



Antonin Filip

In recent years, electronics has registered the fastest growth rate among Czechoslovakia's industrial branches. While in 1984 the overall industrial production rose by 3.9 per cent, electronics recorded a 12.2 per cent increase. This growth rate indicates that in the seventh five year Plan period (1981-1985), electronics production could grow by as much as 50 per cent.

The dynamic growth of electronics in Czechoslovakia has been affected by the fast-increasing manufacture of electronics components and growing supplies of computer technology, communications equipment such as telephone exchanges, radio and television transmitters, and consumer electronics products. To illustrate the point, let us mention that between 1982 and 1984 Czechoslovakia's production of digital computers increased from 322 to 1080 units and of colour TV sets from 71,000 to 142,000.

Competent authorities in Czechoslovakia view electronisation as a major instrument of the qualitative restructuring of the national economy which makes it possible to improve production technology, extend automatic processes, utilise robots and raise the utility value of manufactured products—machinery, production equipment as well as consumer goods.

Experts predict that as early as in the late 1980s it will be possible to introduce electronic systems in 120 out of the 448 production branches in the national economy, in which between 5000 to 6000 practical applications of electronics can be made. It is expected that in the coming years ten to 20 per cent of energy can be saved in this way while significantly raising the productivity of labour. Further, these changes are expected to save up to 300,000 jobs while the workers concerned will find employment in other branches which are currently under-staffed.

One of the key problems confronting the development of electronics and its practical application in Czechoslovakia is that many electronic devices and systems produced in initial small series are too costly to allow mass production. That is why in 1984 Czechoslovakia introduced a dual-pricing system of microelectronic circuits. Higher wholesale prices are paid by manufacturers of components to fully cover costs and to ensure adequate profit. On the other hand, lower prices are paid by consumers which makes it possible to apply electronics in machinery and equipment.

This price differentiation has remarkably stimulated demand for microelectronic circuits. Contrary to originally forecast growth of deliveries by 9.5 per cent in 1984, manufacturers of these devices had to raise production by 21.9 per cent, and in 1985 the production increases were raised from 24.8 per cent to 53.1 per cent.

Following price reductions of some consumer electronic components which came into effect in the past years, in the beginning of 1985 the wholesale prices of some final products were adjusted. The prices of the basic units of the EC-1026 computer and the SAPI-1 microcomputer system were cut down by 29.8 per cent. The price of the EC-7039 line printer which serves as an output for computers also dropped by 8.9 per cent and is expected to lead to a faster expansion of computer technology.

Wholesale prices of some automation and regulating equipment were also reduced, and the prices of control systems used in various machinery and equipment went down by 16.9 per cent to 35.1 per cent. For instance, consumers now pay 26.7 per cent less for the ADT-4500.2 computer. All these price reductions are designed to pave the way for the introduction of automation and regulating devices on a mass scale.

In view of Czechoslovakia's restricted domestic energy resources, great attention is accorded to economical utilisation of all kinds of fuels and energy. Until recently, efforts to save energy in public and industrial lighting ran up against the obstacle of relatively high prices of sophisticated energy-saving illumination sources. This problem was also taken into consideration in the adjustment of prices of electronic equipment.

As of the beginning of 1985, socialist organisations and enterprises pay 42 per cent less for 40W fluorescent lamps, 49 per cent less for 100W mercury discharge lamps and 210W sodium vapour lamps and as much as 57 per cent less for 250W sodium vapour lamps. These price reductions are also expected to provide a fresh impetus for the replacement of existing lighting equipment with more energy-saving sources.

These reductions of the prices certainly do not represent the last step taken by electronics producers. In the coming years, this industrial branch is to broaden its dual-pricing system to cover other groups of products. ☐

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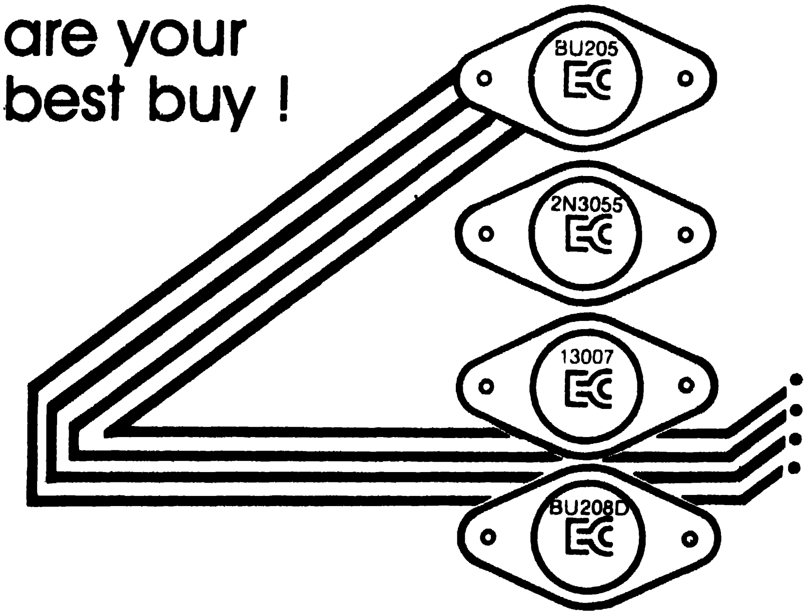

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2N3771	NPN	150	30	50	40	15	60	4	15	0 8
2N3772	NPN	150	20	100	60	15	60	4	10	0 8
2N3773	NPN	150	16	160	140	15	60	4	8	0 8
BUX39	NPN	120	30	120	90	15	45	4	12	8 0
2N3055	NPN	117	15	100	60	20	70	4	4	0 8
EC2955	PNP	117	15	100	60	20	70	4	4	0 8
2N3055A	NPN	117	15	100	60	20	70	4	4	0 8
BDY25A	NPN	87 5	6 0	200	140	15	45	4	2	10
BDY25B	NPN	87 5	6 0	200	140	30	90	4	2	10
BDY25C	NPN	87 5	6 0	200	140	75	180	4	2	10
ECN055	NPN	50	5 0	60	50	25	100	2	2	4
ECP055	PNP	50	5 0	60	50	25	100	2	2	4
ECN149	NPN	30	4 0	50	40	30	—	2	0 75	0 8
ECP149	PNP	30	4 0	50	40	30	—	2	0 75	0 8
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EC820	NPN	50	5 0	1500	600	8	20	5	1	3
BU536	NPN	62	8 0	—	480	10	—	5	1	3
BU208D*	NPN	60	5 0	1500	700	2 5	-	5	4 5	7
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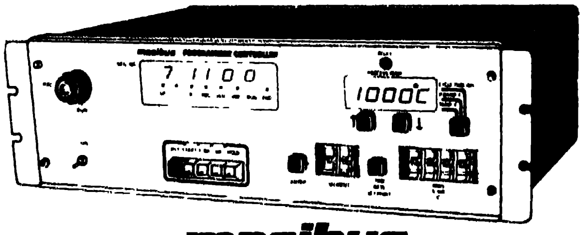

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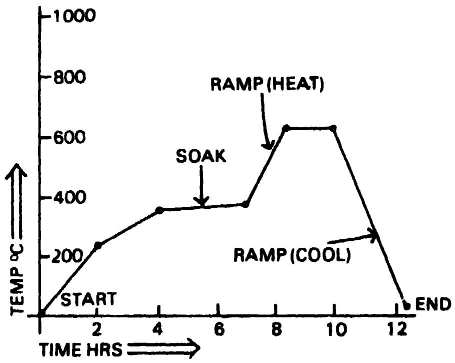

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Computer Corner

Course assessment and performance system

The managements of training institutions/schools/education boards/colleges/universities/competitions conducting bodies like UPSC etc, often find cumbursome and time consuming the task of finalising the results of students/candidates or monitoring the performance of the class during its conduct. The problem is more than aggravated if their number is very large.

For the first time in the country, a Course Assessment and Performance System [CAPS] implemented on a local area network [LAN] consisting of a mass storage from Corvus Systems, Inc., USA, and Apple or Apple-compatible microcomputers has been installed at the Military College of Telecommunications Engineering [MCTE] solve this problem.

Without any modifications, the system can also be used in stand alone mode with an Apple/Apple-compatible computer system having a hard winchester disc and only one flexible disc drive with CP/M operating system.

CAPS is a user friendly, interactive system, which accepts users' answers from the keyboard, in response to very simple and easy-to-understand questions which it displays on the screen.

Optical disc computers

A way of using pulses of light instead of pulses of electricity to carry messages in computers could be reality for researchers at Edinburgh's Heriot Watt University.

For, the first experimental optical computer is expected to be ready for testing there in late 1986. A research team under Professor Desmond Smith, a world leader in methods of using optical components in computers, began work on the project more than five years ago.

The team has shown the type of optical components from which complex computers could be built using devices that are the optical equivalent of transistors. The components are called transphasors.

The advantage of optical computers is that such machines, if perfected, could work thousands of times faster than the best electronic ones and they could process data in important new ways.

The increase in speed is made possible because light does not suffer the disadvantage of electrons which are slowed to a few per cent of the speed of light in silicon microchips.

A total of over 2000 optical disc filing systems have so far been installed in Japan since the first system was installed in 1982 to work as a document filing system. The discs range in diameter from 20 to 30 cm. The storing capacity, which depends on the disc size, is generally very large, the average disc being able to store between 15,000 to 60,000 A4 pages of information.

Computer units record 218 per cent growth

The centre's move to liberalise the computer policy seems to have paid off handsomely. The computer industry of India, yet in its infancy, has recorded a breathtaking 218 per cent growth rate for the year 1985.

In monetary terms, the growth rate recorded stood at an astounding 78 per cent.

Disclosing this at a seminar on 'computers in Indian management-an update', in Calcutta, Dr N. Seshagiri, additional secretary in the Department of Electronics [DoE], said 'the DoE was trying to convince the government to lift the many controls on computer technology import.'

Applauding the achievement of the computer industry, Dr Seshagiri said 'the achievement would assume greater significance seen in the backdrop of a 40 per cent fall in prices of computers.'

Dr Seshagiri believed that the industry was capable of maintaining at least 100 per cent growth rate in the future.

Supercomputer for India?

A top-level team of Indian computer experts from the DoE visited the Control Data Corporation's headquarters at Minneapolis to evaluate the US supercomputer to determine its usefulness for India's requirements.

The visit came off as a result of an invitation from the manufacturers of the supercomputer. The Reagan Administration also sent an official to Minneapolis to observe the developments which are likely to bring New Delhi and Washington to the last phase of talks on the proposed sale of the world's most sophisticated computer.

Though there are some indications that India may be able to acquire the super computer, the Reagan Administration has not yet disclosed its stance officially.

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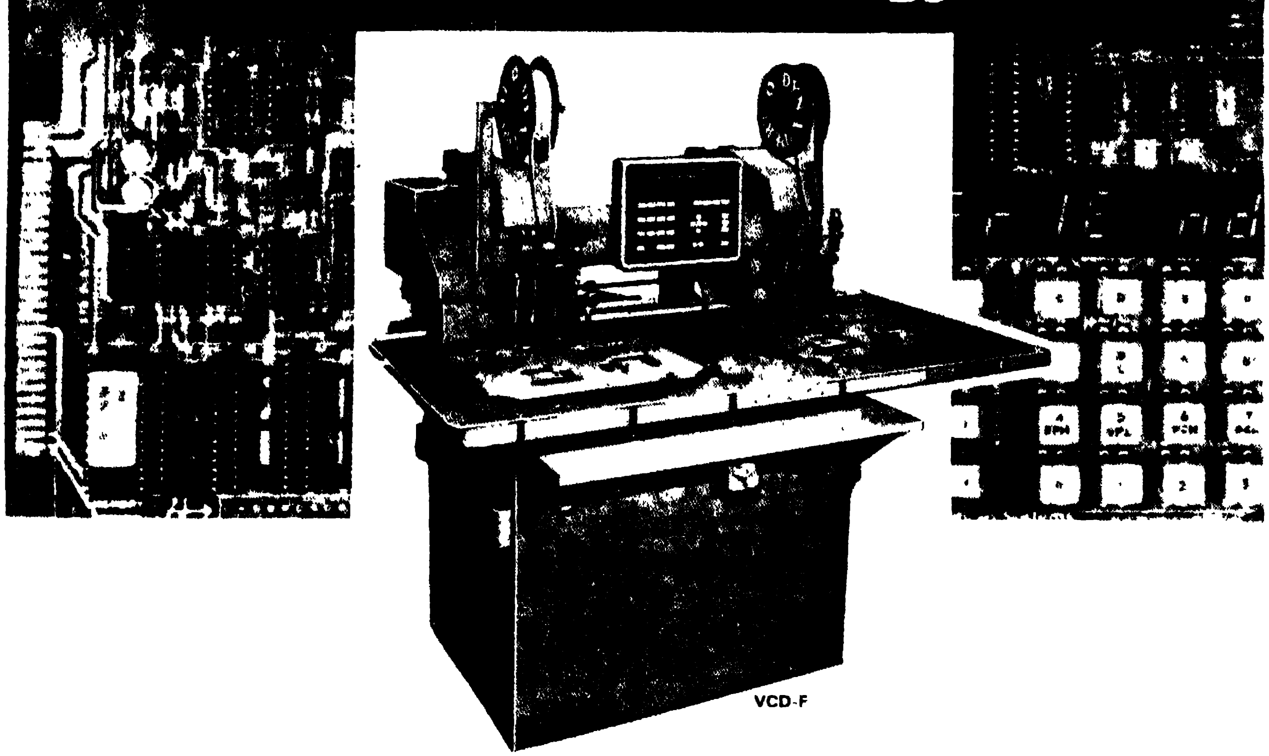

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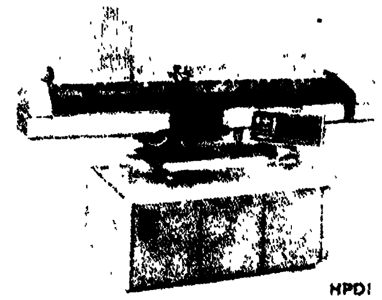

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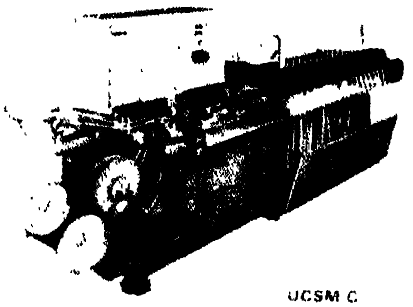

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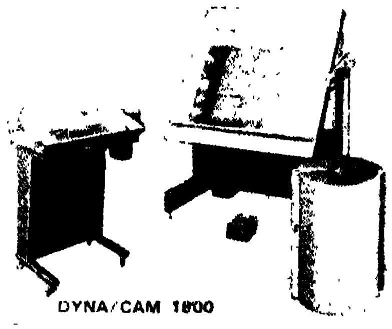

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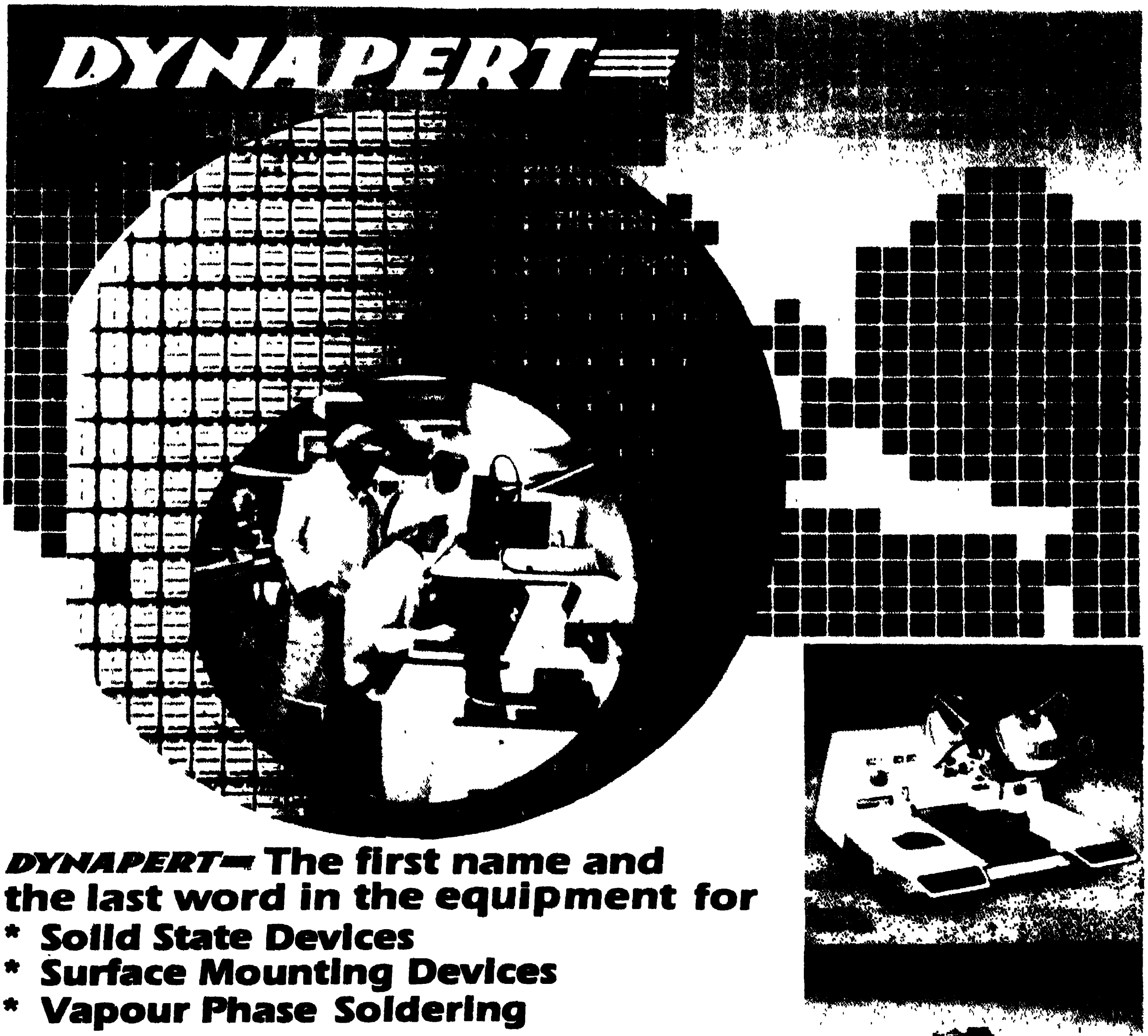

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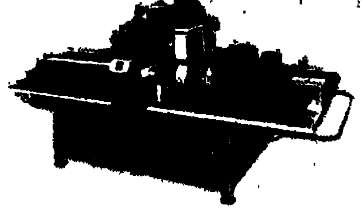

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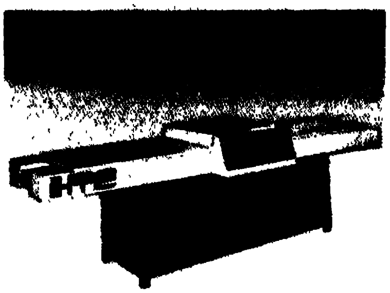

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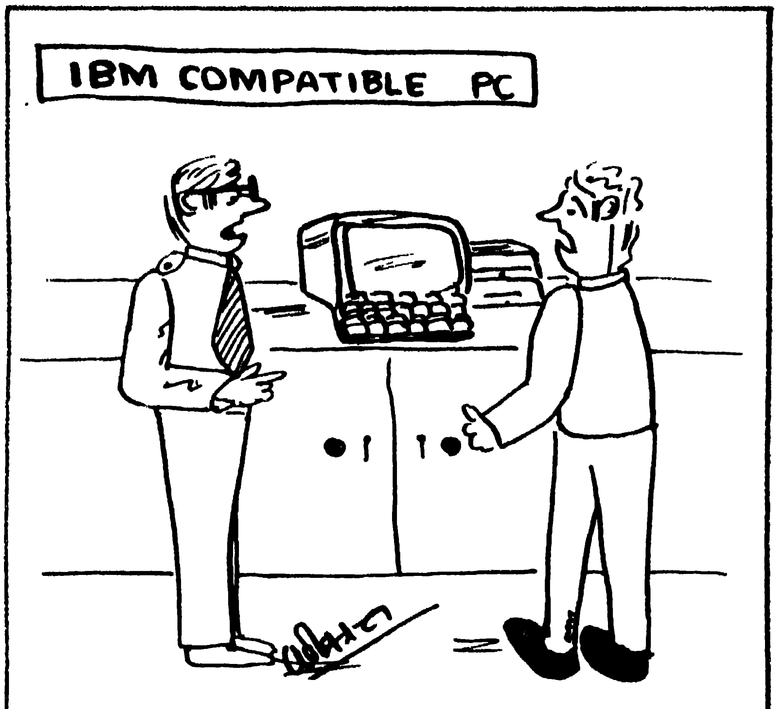

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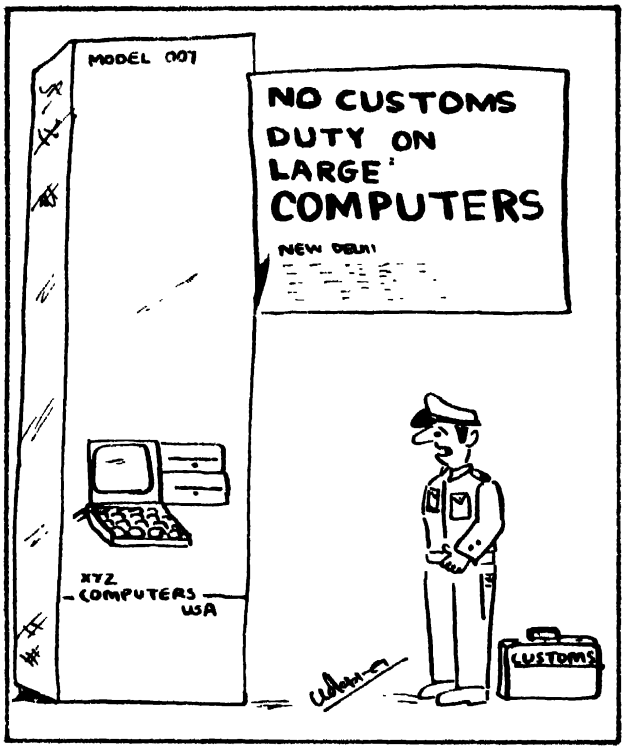

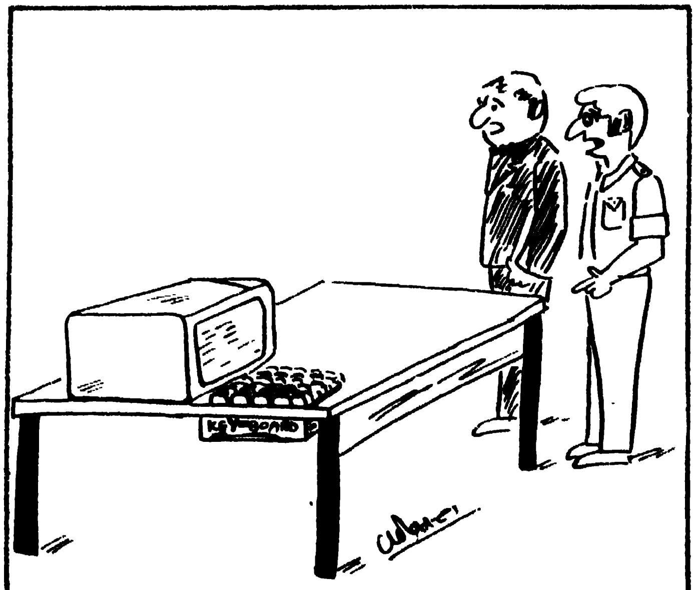

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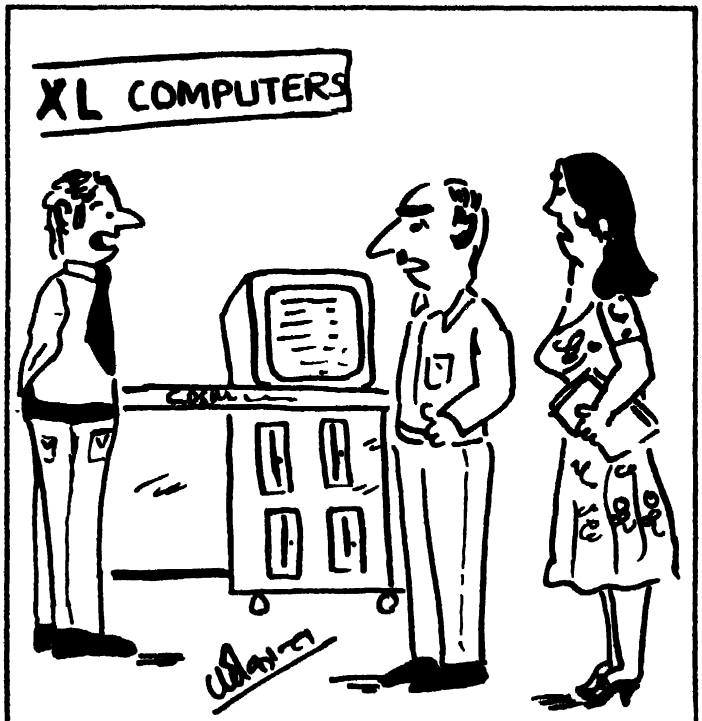

"In fact, our computer does not require airconditioning, but your secretary may..."

Principle of Moving Head Disc

S. Batra

In every computer system there is a main memory. This normally comprises of semiconductors i.e., IC's or ferrite cores (introduced in the recent past). Every computer, depending upon its capacity, provides certain amount of main memory (MM). If the capacity of the computer system has to be increased, obviously the size of the MM has to be increased.

It is not economical to increase the size of MM beyond a certain limit. In such cases, other peripheral devices are used to augment the MM capacity. They behave as a part of MM and their performance characteristics are very similar to that of MM for all practical purposes. Various peripheral devices used for such purposes are magnetic tape drive, fixed head discs and moving head discs.

For reasons of large storage and reasonable access-time, moving head discs are very commonly used in the medium and large computer systems. They provide large storage capabilities with moderate operating speeds. A variety of magnetic drives are now available. Although differing in specific details, all of them are based on the same operation principle.

One or more rotating discs coated with magnetic material are stacked one above the other with some space between each disc. Information or data is recorded on the surface of the rotating discs by magnetic heads which are positioned against the discs. Unlike the music records or discs, the information is not recorded in a spiral but in bands. Each band of information around a given disc is called a 'track'.

Major assemblies

Major assemblies of a typical disc are shown in Fig. 1. They consist of linear positioner, air system, read/write heads, drive system and disc.

Linear positioner. It consists of the linear motor, the carriage and the read/write heads. To move the read/write heads across the recording disc, DC current is applied to the

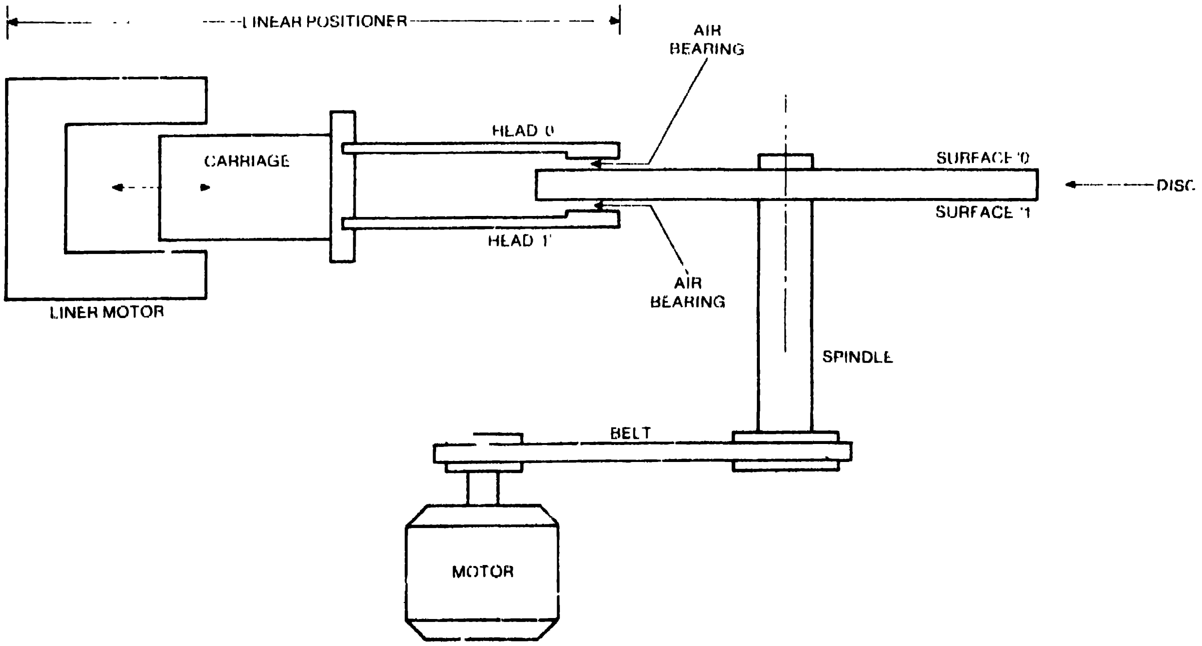

Fig. 1: Simplified diagram of a single disc drive.

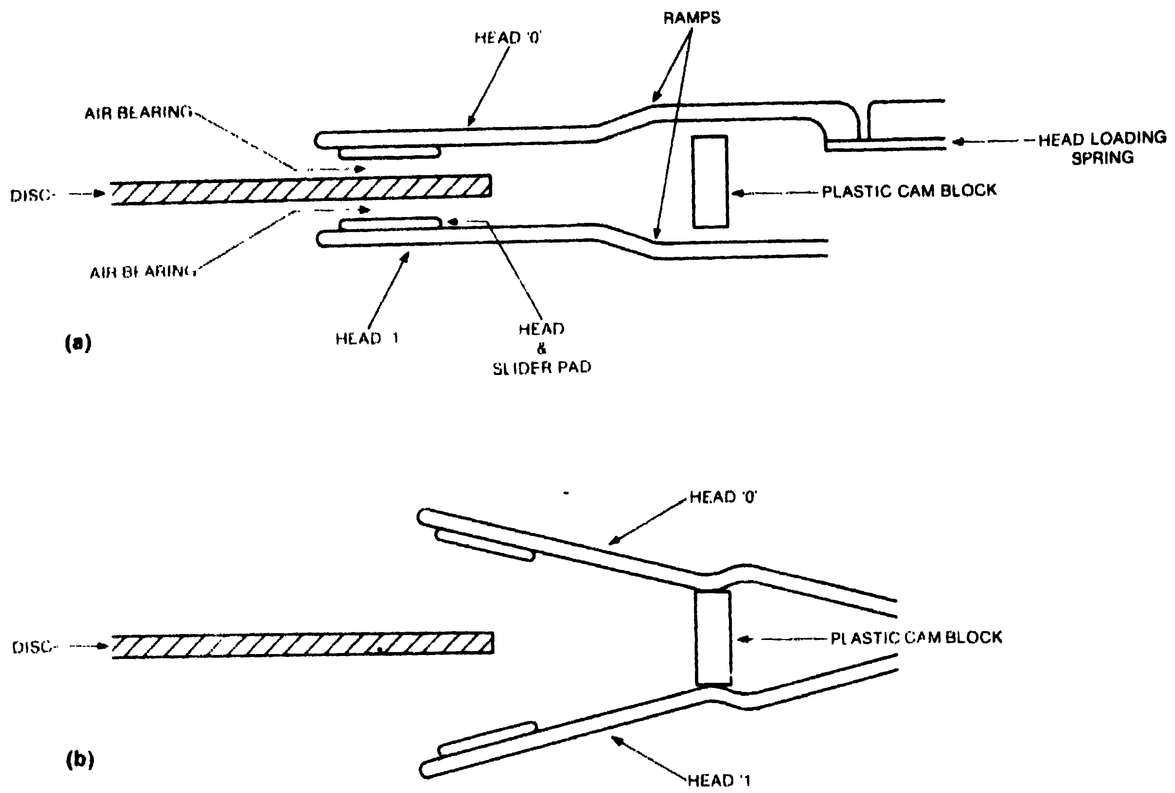

Fig. 2: Single disc head assembly: (a) head loaded, (b) head unloaded.

bobbin-wound armature of the linear motor. The resulting magnetic field reacts with a permanent magnet in the motor-housing to either pull the armature into or force it out of the permanent magnetic field, depending upon the polarity of the current applied to the armature. This motion is transferred to the carriage, which is fastened to the armature. As a result, the R/W heads, which are attached to the carriage, move across the surface of the disc.

Air system. The air system has a blower. It passes the air through a filter where even minute contamination is removed. The purified air is taken to the disc over which the R/W heads move across in the air. The R/W heads do not touch the surface of the disc. Contact with the surface spoils the oxide-coating on the disc.

Read/write heads. One head functions on the top surface of the recording disc and the other functions on the bottom surface. The heads are mounted on the suspension arms that rest (when the heads are unloaded in the disc) on a plastic cam block of duckbill (see Fig. 2). Flat cantilever springs connect the suspension arms to the head-support tail pieces. When the drive (moving head disc) is placed in run mode, the positioner moves the heads forward towards cylinder zero (outermost). When the entire head slider pad has passed the edge of the disc, a ramp on the suspension arm slides down the edge of the plastic cam block thereby moving (loading) the heads close to the disc surface. As many R/W heads as the total number of surfaces are used and mounted in a comb-like arrangement as shown in Fig. 3.

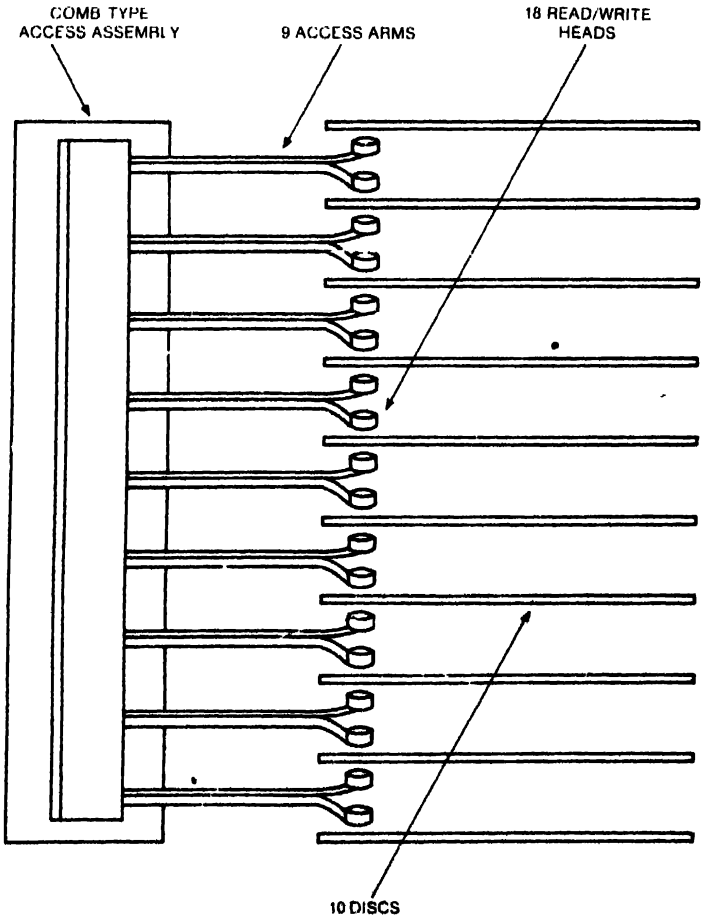

Fig. 3: Multiple disc/head assemblies.

When loaded, the heads 'fly' about 30-100 microns from the disc surface. A film of air (air bearing) between the disc and the head exerts a force away from the disc while the cantilever spring acts as the counter-balancing force towards the disc. Thus, as long as the disc rotation remains constant, the heads remain at a relatively constant distance away from the disc surface.

Each head is a 4-terminal magnetic device containing two coils (see Fig. 4). A centre-tapped coil performs the read or write function while the other series-connected coil performs the erase function. The head is designed so that the erase coil is electrically connected to the centre tap of the R/W coil and is energised whenever a write operation occurs. This type of head configuration called 'straddle erase' erases most of the residue from prior recording between the tracks and thus eliminates track 'cross talk' or interference from such recording.

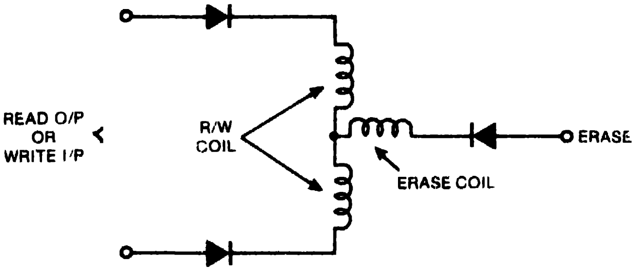

Fig. 4: Simplified diagram of read/write head

In a typical moving head disc having 400 tracks/surface, data tracks are 0.1mm (0.004inch) wide with 0.025mm (0.001inch) erased separation bands. During a write operation, current through the write-coil automatically overwrites old data.

Drive system. The motor drive system consists of a spindle, belt, motor and recording disc. The motor is generally mains-operated split-phase which drives the spindle pulley through the drive belt. The speed of the motor also decides the 'access time' of the disc. Faster the speed, lesser the access time. The spindle-speed is held constant through a servo system in the disc drive.

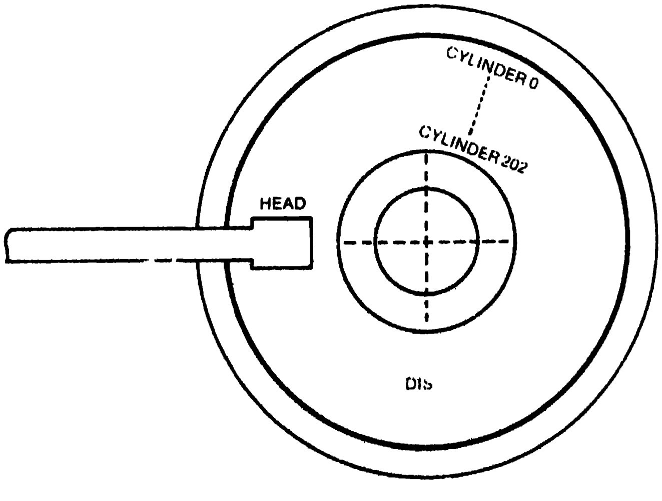

Fig. 5: Surface of a typical disc

The disc has a very fine (30-100 microns) coating of ferrousoxide on a suitable base (as shown in Fig. 5). A typical disc has a radius of 17.8 cms. The area within about 7.5 cms from the centre is required for hub-mounting and 5 to 7 cms from the outer side for data recording. The disc surface may have 12, 16, 18 or 22 sectors (as shown in Fig. 6). Each sector may contain 256 or 512 words in every track

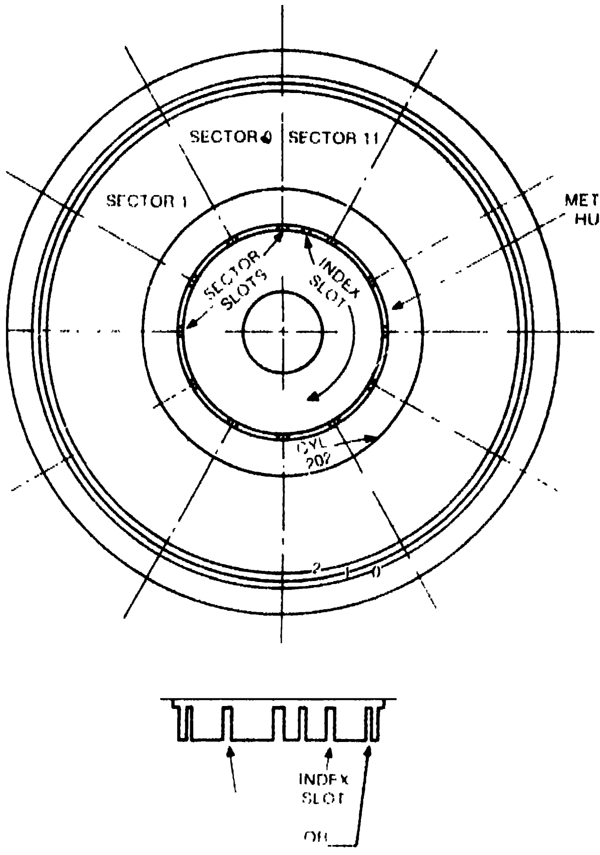

Fig. 6: Plan and elevation of a disc.

Sector is defined by a slot called sector slot. These sector slots when sensed by a photosensor generate pulses from the disc drive to the controller. Another similar slot called index slot (detected by different spacing length) defines the starting point for the sequence of sectors.

Recording technique

The Recording head is a coil-wound ferrite core with a gap. As current flows through the coil, the induced flux magnetises the surface of the disc passing through the gap. During a write operation when the current direction in the coil is reversed, a flux reversal is recorded on the disc. During the read operation, the previously recorded flux pattern on the disc induces current in the head. Any flux reversal on the recording surface produces a pulse.

The most commonly used method of recording is double frequency NRZ (non-return to zero) method of magnetic recording. In this method, flux reversal (see clock pulses in Fig. 7) are recorded on a magnetic disc at regularly spaced intervals. The time period between these clock pulses is a bit cell and data storage occurs within these cells. A flux reversal during a bit cell represents a logical 1. The absense of a flux reversal during a bit-cell is a logical 0.

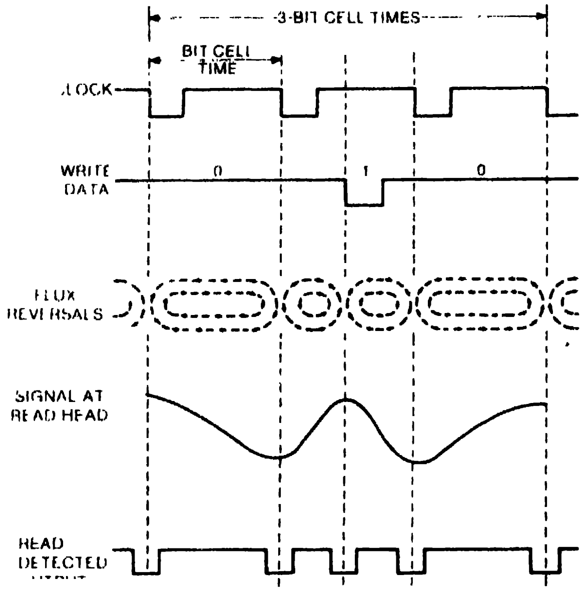

Fig. 7: Double-frequency recording.

Some definitions

Some technical terms which are often used in association with the moving head discs are explanied in the following paragraphs.

Access time and seek time. The time taken to position a head on the selected-track is called the seek time. The other time delay in locating selected data is the latency or rotational delay, which is the time required for the desired data to reach the magnetic head once the head is positioned.

The total time it takes to begin reading selected data or to begin writing one selected track in a particualr place is called the access time.

Total access time = Seek time + Latency

Cylinder. As the discs are stacked exactly one above the other, a particular track will be lying in the same vertical plane for every surface of all the discs. All such tracks considered together are termed as the particular cylinder. Its capacity is given as:

Capacity of particular cylinder = Capacity of a track × Total no. of surfaces used

Flying height. R/W heads used on magnetic discs are almost 'flying' type. A simplified diagram of a flying head is shown in Fig. 8. When the disc rotates at high speed a thin boundary layer of air rotates with the drive. The head is so shaped that it rides on this layer of rotating air which causes the disc to maintain separation from the head, thus preventing wear on the surface of the disc. In effect, the layer of air rotating with the disc acts like a spring with a stiffness of the order of several thousand pounds per cm, thus forcing the head away from the surface of the disc.

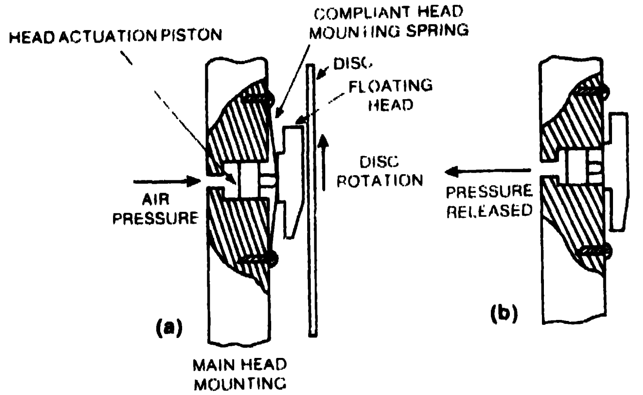

Fig. 8: Head shown in: (a) operating position, (b) retracted position.

Often, compressed air is simply blown in which forces the head towards the surface of the disc. The minimum distance between the surface of the disc and the head (when in operation) is known as the flying height of the disc

Formatting. Information or data is stored in the disc in groups of 12, 18 or 22 sectors per track (depending upon the design of the disc). Each sector of all the tracks and all the surfaces of the disc-pack contain a 'header'. Header is an area in the sector where the cylinder number is written. In the write operation this header of the sought sector is first read and compared with the required cylinder number where the data is to be written. If they match, the data is written on that sector.

The disc, as it comes from the factory, is completely blank. On every sector of every track and on every surface of the disc, the respective header, i.e., the cylinder number is written with the help of a particular program. This process of writing the headers is called formatting of the disc. This is essentially done before putting the disc in operation.

Recording scheme. The data on the disc is recorded in a particular scheme. Every surface of the disc is divided into tracks or cylinders. Therefore, to record (write) or read the data, the drive number has to be defined first. Further, surface number, cylinder number and sector number have to be defined to access the exact area by the heads.

When the bulk of data is to be recorded, the head assembly of the selected drive moves to cylinder O position from its normal home position. The head of surface O is energised. The data is written on sector O till the last sector. If the data overflows, the head of the next surface, i.e., surface 1 is energised (and surface 0 de-energised) and the data written one by one on all the sectors of the same cylinder. If the data still overflows, it is written on the various sectors of next surfaces of the same cylinder till all the surfaces are over. If the overflow persists, the head assembly then moves to the next cylinder (i.e. cylinder 1) position and the same sequence continues. When all the cylinders of the disc are exhausted, the data overflows to the next disc (i.e. disc 1), and so on.

Comparative specifications

There are various sizes and speeds for disc memories. Some discs are quite large, ranging up to 1.2 metres in diameter. Others are smaller, rotate faster and are changeable. A typical changeable type or module type may have 20 recording disc surfaces consisting 10 discs. In most configurations top of the top disc and/or bottom of the bottom disc are not used for data recording. The table given compares the performance characteristics of a few discs:

DISC MAKE	DIGITAL RK05	CDC 215	UNIVAC 8440	IBM 3330-11
No of surfaces	2	20	20	19
Capacity in MB (mega bytes)	2 5	54	108	200
Track per inch	100	200	200	384
Data transfer rate (in mega bytes)	1 44	2 5	5 0	6 5
Av access time (in msec)	50	30	30	30
Rev/min	1500	2400	2400	3600
Disc coating in μin	200	90	50	40
Flying height in μin	100	80	70	30

The block diagram of the typical disc drive system is shown in Fig. 9. With one controller, four to eight discs can be connected in daisy-chain depending upon the memory capacity required.

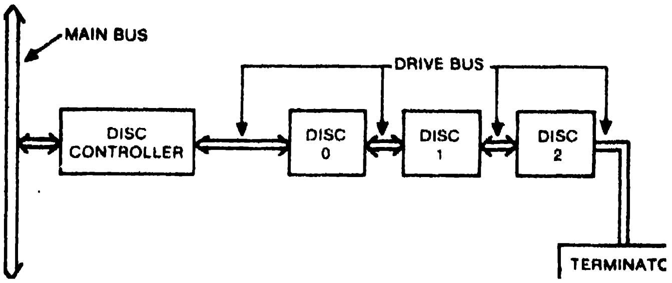

Fig. 9: Block diagram of a disc drive system.

In the daisy-chain system, the processor of the computer system puts the address of the required disc drive on the bus. The disc-controller fetches the address from the bus and passes it on to the first drive. The first drive decodes the address and if it happens to be its own address, it responds to the processor and performs the data-transfer. If the address does not pertain to the first drive, it passes it on to the next drive. This way the required drive gets selected in the daisy-chain operation.

Because of the relative inexpensiveness per bit of information or data stored in disc memories, and because of the relatively low access time and the high transfer rates attainable when reading or writing data from or into a disc file, magnetic disc memories have become one of the most important storage devices in modern digital computers. ☐

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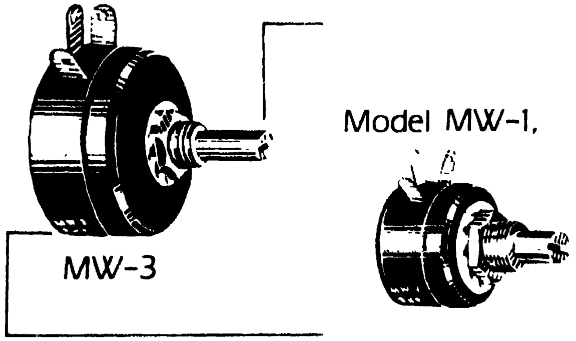

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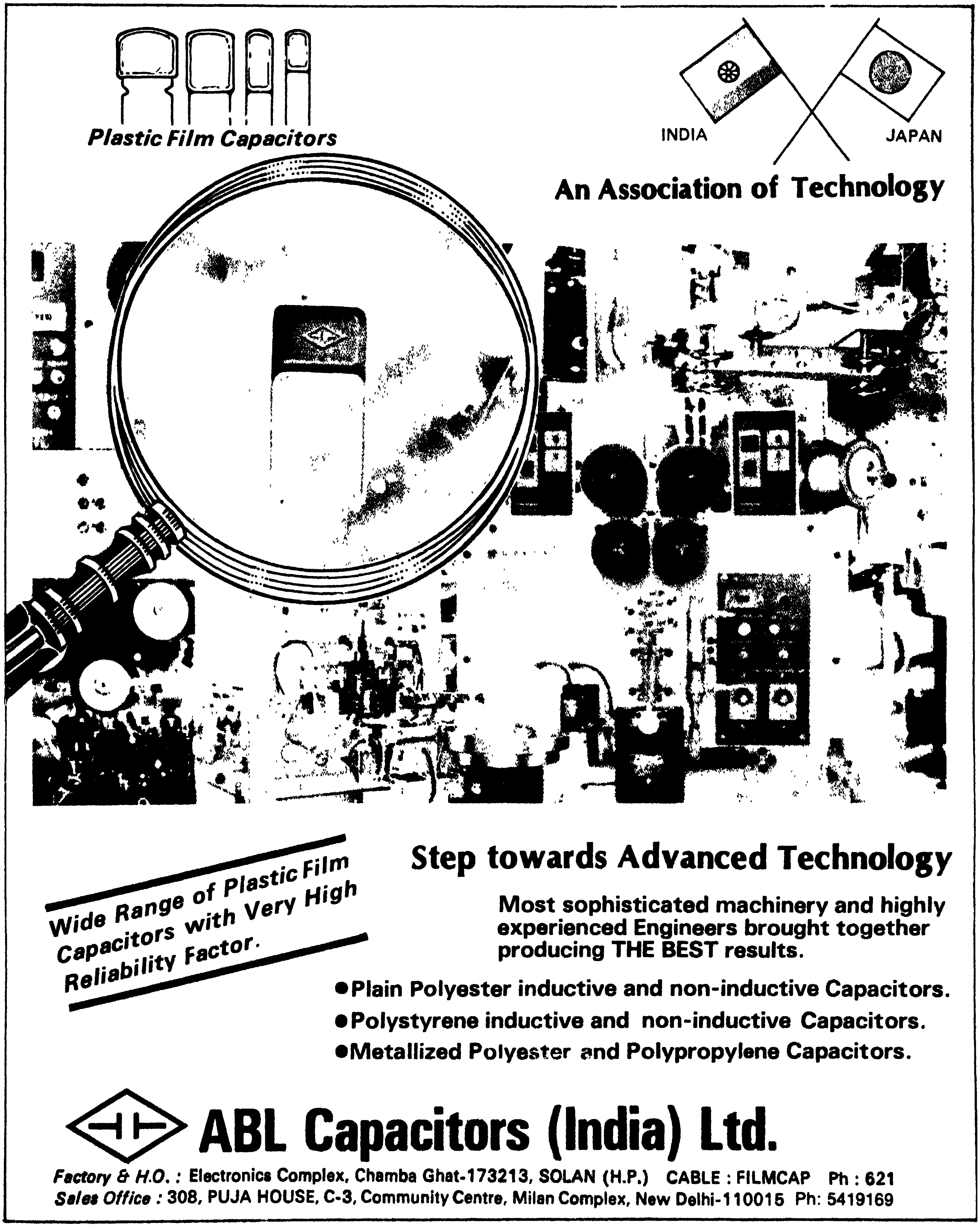

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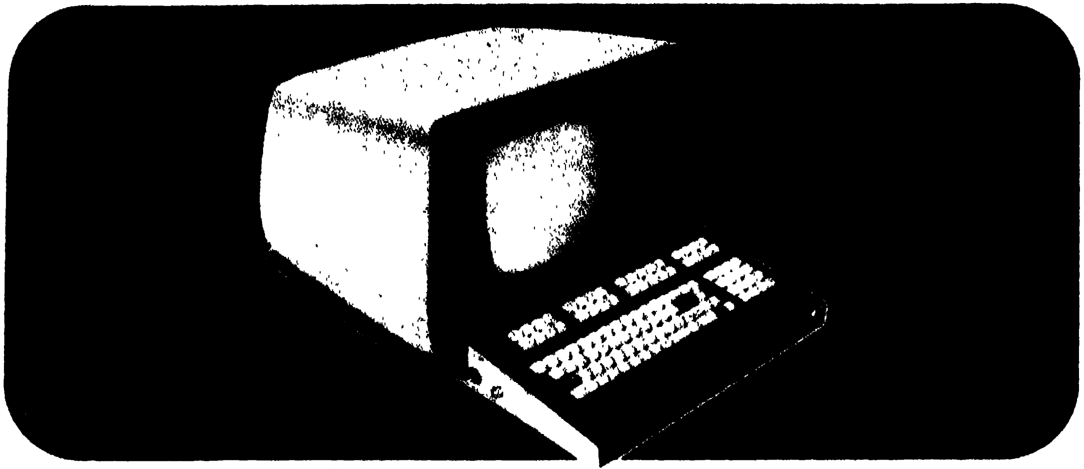

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Ajay Chikersal

This construction project turns your Sinclair Spectrum Microcomputer into a Digital Resistance Capacitance Frequency Meter (DRCFM), capable of measuring resistances of 1 ohm to 10 megohm, capacitances in the 10pF to 5000μF range and frequencies as high as 100 kHz.

This project is different from all other interface projects you might have seen. It is cheap, interface is directly through the EAR socket (not the edge connector) and the circuit itself is so simple that it's sure to work the first time you connect it.

Working

The circuit is a free running astable multivibrator using the 555 timer chip. The output of the astable multivibrator is fed into the Spectrum through the EAR socket. The multivibrator produces square wave pulses, the frequency of which depends on the values of resistors and capacitors connected.

The machine language program (listing given in Fig. 1) is a simple counter which can count from 1 to 65535.

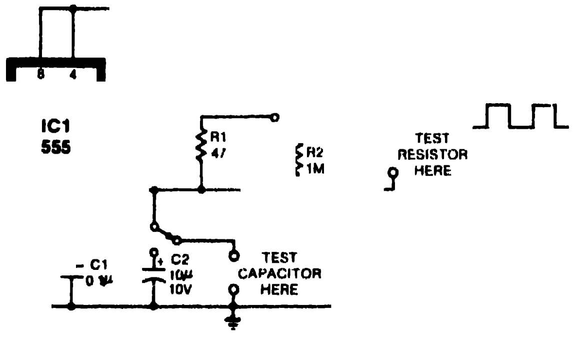
As the circuit is designed to give an equal mark/space ratio, the time periods of mark and space are equal, given by

$$T1=T2=0.7RC$$

Hence the total time period is given by

$$T=1.4RC$$

The circuit diagram of the main interface.



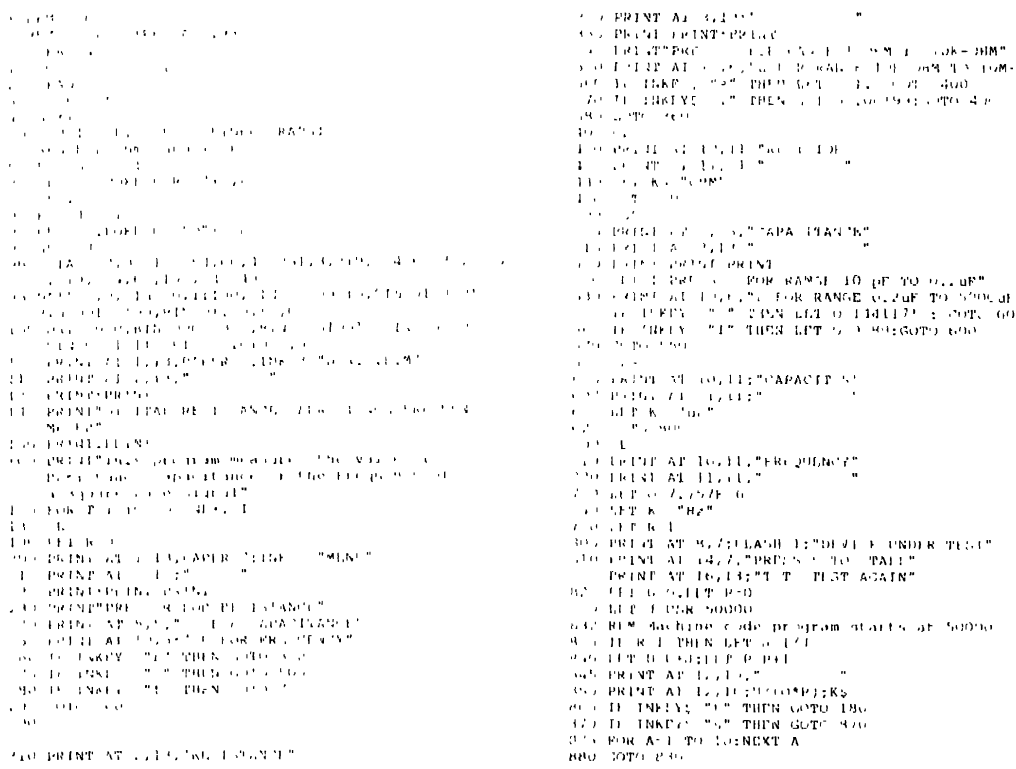
Resistors and capacitors should have close tolerances. (See text.)
S1, S2 are single-pole, 3-way switches.
Use crocodile clips or spring-loaded contacts for test resistor and capacitor.

PARTS LIST

IC555	— 1 no.
47-ohm (¼watt, 1% metal film)	— 1 no.
1-megohm (¼watt, 1% metal film)	— 1 no.
0.1μF ceramic	— 1 no.
10μF, 10V electrolytic	— 1 no.
1-pole, 3-way switch	— 2 nos.

IC sockets, crocodile clips, connecting cords, Sinclair Spectrum, colour TV/monitor, enclosure, and cassette recorder.

PROGRAM LISTING



where 'R' is the resistance and 'C' the capacitance. A single count by the counter represents approximately 8.4×10^{-6} seconds. As the counter measures the total time period, the smallest measurable time period would be a single count or 8.4×10^{-6} seconds. So the highest measurable frequency is

$$f = \frac{1}{T} \approx 100 \text{ kHz}$$

If you notice the Z-80 assembler instructions (Fig. 1) carefully, you will come across the instruction IN A, (254). The action of this instruction is to load register A with the contents of input port 254 (representing the EAR socket). When no signal is applied to the EAR socket, register A contains the byte 255; when a signal is detected it contains 191.

Fig. 1: Machine code listing

Address	Hex	Z-80 Assembler
50000	01 00 00	LD BC,0
50003	DB FE	IN A, (254)
50005	3C	INC A
50006	28 FB	JR Z, -5
50008	03	INC BC
50009	DB FE	IN A, (254)
50011	3C	INC A
50012	20 FA	JR NZ, -6
50014	03	INC BC
50015	DB FE	IN A, (254)
50017	3C	INC A
50018	C0	RET NZ
50019	18 F9	JR, -7

To understand the action of this input port, type in the three line BASIC demonstration program (Fig. 2). Now load any cassette into the Spectrum (Rock, Pop, Jazz—even M.J. will do). The switching of numbers seen on the screen should give you the idea. By testing for the bytes 255 and 191, the machine language program is able to count the total time period of a single square wave pulse.

Fig. 2: Program to demonstrate input port-254.

```
10 REM DEMONSTRATION
20 PRINT AT 10,14; IN 254
30 GO TO 20
```

So by using a simple constant to relate computer count to seconds, we can measure the frequency of the incoming signal.

Due to its logical behaviour the computer can judge square waves best. Hence the use of a multivibrator instead of the conventional sine wave oscillator.

Once standardised with a known value of resistance and capacitance, it can then measure the value of either when the other is known.

Setting-up

The above paragraphs would have given you an insight of the actual working and the coordination between the external circuit and the Spectrum.

In order to get the project working, all you have to do is to connect the output of the astable multivibrator into the EAR socket of the Spectrum, type in the BASIC program, RUN it and move the switches S1 and S2 to their appropriate setting, insert the test device and observe the readings.

Fig. 3: Schematic showing the set-up to load the program.

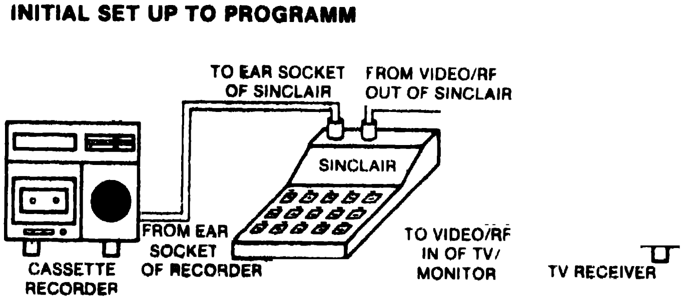
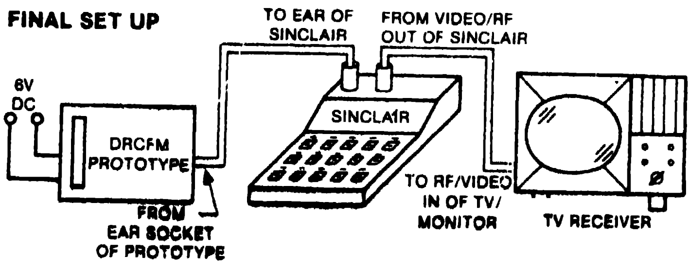

INITIAL SET UP TO PROGRAMM
TO EAR SOCKET OF SINCLAIR
FROM VIDEO/RF OUT OF SINCLAIR
SINCLAIR
FROM EAR SOCKET OF RECORDER
TO VIDEO/RF IN OF TV/ MONITOR
CASSETTE RECORDER
TV RECEIVER

Fig. 4: Schematic showing the set-up for 'measuring' the component values using the prototype.


FINAL SET UP
TO EAR OF SINCLAIR
FROM VIDEO/RF OUT OF SINCLAIR
6V DC
DRCFM PROTOTYPE
SINCLAIR
TO RF/VIDEO IN OF TV/ MONITOR
TV RECEIVER
FROM EAR SOCKET OF PROTOTYPE

For example, if you want to measure the value of a resistor which falls in the 1-ohm to 10-kilohm range, switch S1 should be moved to the 'TEST' position and switch S2 moved to the 10µF position. Please refer to Fig. 5, which will help you to decide the range and setting.

Fig. 5: Ranges with different switch settings.

Switch settings	Range
S1	To test capacitance
47-ohm	0.2µF to 5000µF
1-megohm	10pF to 0.2µF
S2	To test resistance
10µF	1-ohm to 10-kilohm
0.1µF	10-kilohm to 10-megohm

I have already standardised the value of constants used for computing the values of resistance, capacitance and frequency. However, by using the formula for time period with the values of resistance and capacitance used in the circuit, you can recalibrate to your satisfaction. To recalibrate, you must alter the value of variable '0' to suit the calculations of the time period. The variable '0' is contained in the following lines of the BASIC program: 360, 370, 550, 560 and 730.

I would strongly suggest you to use a 5V supply as the internal circuitry of the Spectrum uses 5V.

Be extremely careful while typing line 96 in the BASIC program. Since this line contains all the codes for the machine language program, one mistake and your Spectrum will most likely go into a 'crash' as soon as you run it. ('Crash' is machine language jargon for program overrun.) This stubborn mode of the Spectrum might dazzle you with colour and graphics but will definitely shock you when you learn that the only way of getting the Spectrum back to its normal mode is to turn it off and on, thereby losing the entire program.

I would also suggest you to use resistors and capacitors of very close tolerances as this will not only ensure proper matching between my standardisation of formulae and your components, but will also help you to recalibrate in order to obtain good readings.

Try the BASIC demonstration program again. This time press different keys and observe what happens on the screen. You will notice that the contents of input port 254 get affected by pressing the keys. So here's another precaution. Don't press any key on the keyboard while measuring the value of the test device.

The symbols Ω (ohm) and µ (micro) in the BASIC program listing can be obtained by using Graphic 'o' for ohm and Graphic 'm' for micro.

The BASIC program was written for a 48k Spectrum. However for the benefit of 16k Spectrum owners I have listed the amendments in Fig. 6.

Fig. 6: Amendments for 16k Spectrum.

```
  5 CLEAR 32499
 10 FOR L=32500 TO 32520
830 LET J=USR 32500
```

Recalibration

Let me illustrate the process of recalibration by considering a practical example.

Set switch S1 to 1-megohm and switch S2 to 0.1µF.

Now the time period of the square wave generated is given by the formula

$$T=1.4RC$$

Substituting the value of resistance and capacitance in the above formula, we obtain

$$T=1.4\times10^{-2} \text{ seconds}$$

Now insert another line in the BASIC program

```
827 LET 0=1
```

so that you obtain the exact averaged computer count. If you wish to calibrate with reference to your 1-megohm resistor, you will find that the range corresponds to switch position S2 to 0.1μF.

By simple arithmetic manipulation to the formula of line 850, you can find the value of '0' so that you get 1-megohm as the answer.

As this value of '0' corresponds to the range 10-kilohm to 10-megohm, it should replace the existing value of '0' in the line 370. Don't forget to remove the additional line 827 after you have finished recalibrating.

Further applications

The circuit is so simple and versatile that with only two parameters of control it can be easily modified to suit endless purposes.

Here are a few ideas to experiment with:

1. Replace the resistor by an LDR (light dependent resistor) .... Light meter!
2. Replace the capacitor by a grid of parallel plates (similar to a parallel plate capacitor) .... Rain alarm, Moisture meter!
3. Replace the resistor by an LDR which is encapsulated with an LED, the latter being supplied with voltage from an independent supply .... Digital voltmeter!
4. Using a sensitor (a silicon resistor) in place of the resistor .... Thermometer!

□

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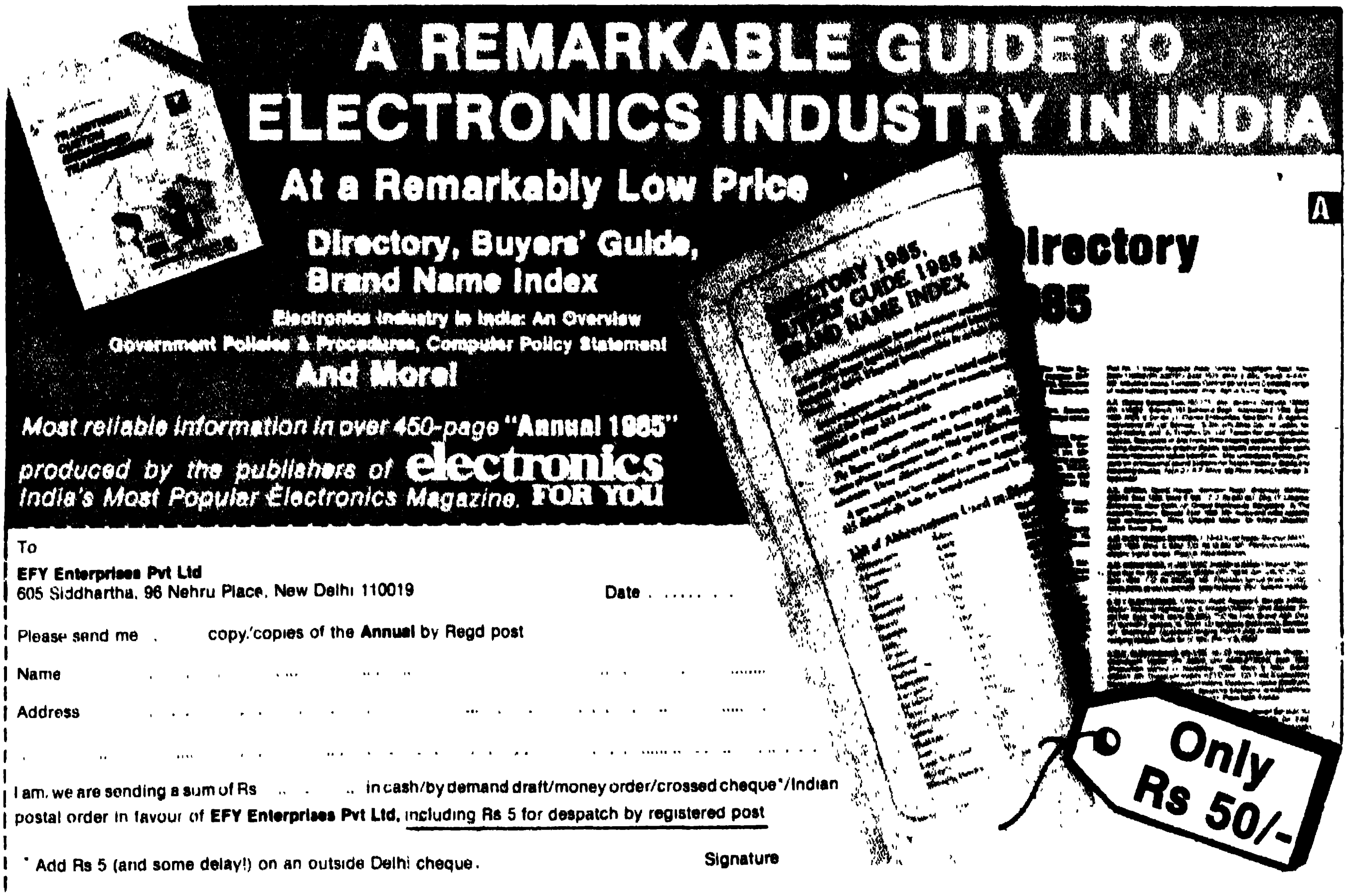

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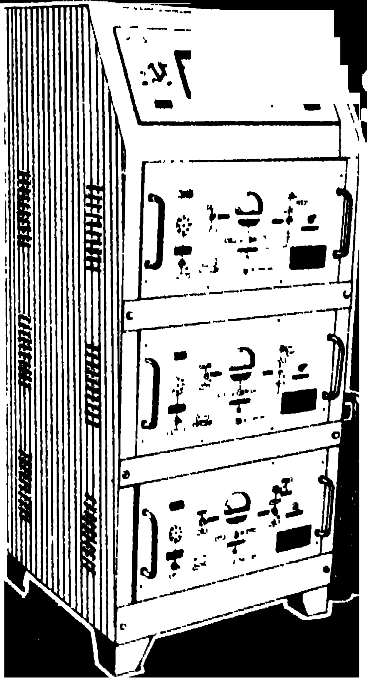

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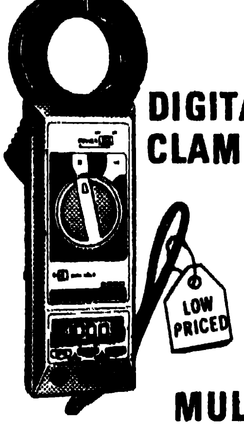

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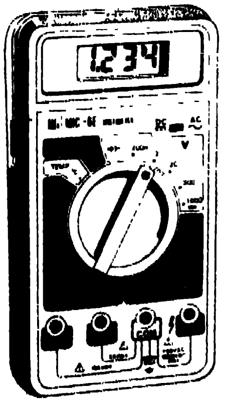

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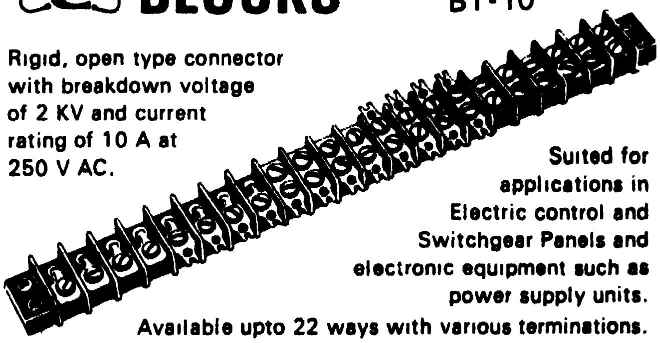

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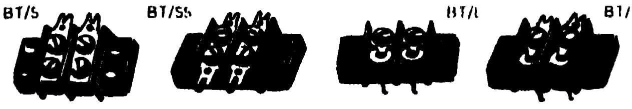

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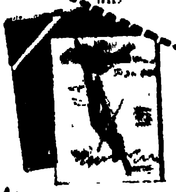

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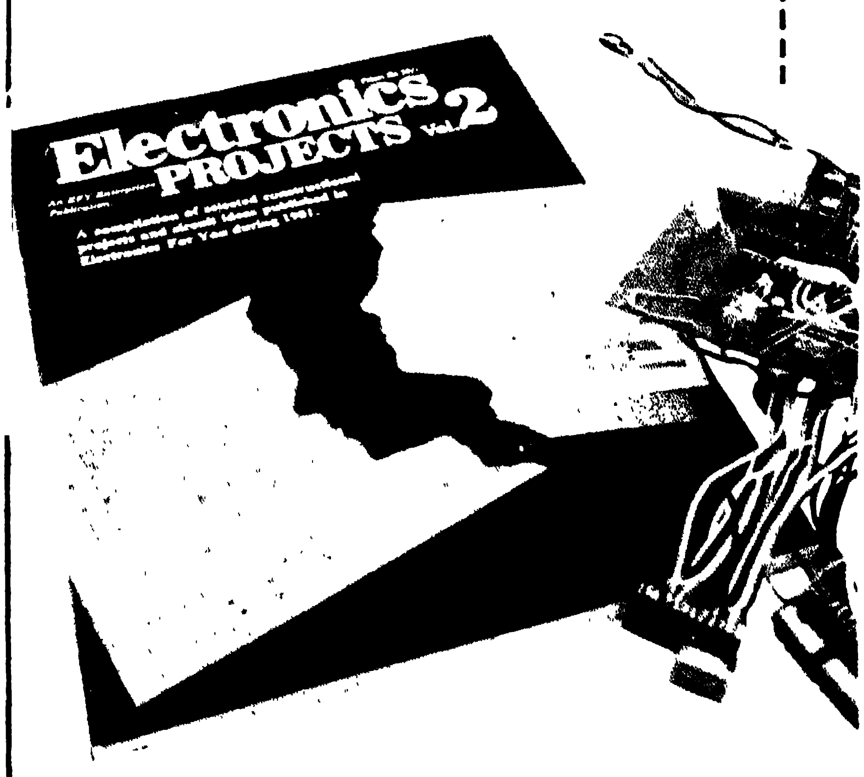

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Comparative Study of Computer Languages

Library Functions

Part VIII

R. Ramaswamy

In scientific computations, several functions like sine, cosine etc will be repeatedly used. The values of such functions have to be obtained by executing a program for such evaluation. If a sine function occurs ten times in a program, the segment of the program for evaluating the sine function must be written ten times. If we use subroutines (we will discuss later about subroutines) the program segment must be written at least once. Even this is avoided in the case of library functions. The program segments for evaluation of such oft-repeated functions form part of the language itself.

The FORTRAN compiler provides for the computation of such oft-repeated functions by storing the program for such computations. A code name is given for invoking the function in the main program. Immediately following the code name, a variable or a constant or an expression is enclosed within parantheses, called the argument of the function. The program will use the computed value of the argument to evaluate the value of the function itself and return it to the main program. The general form of the library function is:

function-name (argument)

The function name is coined in such a way that it is indicative of the nature of the function and it is given by the compiler designer. Suppose one writes SQRT (24.5), the term SQRT is called the name of the function and the number 24.5, the argument of the function. The purpose of this function is to compute the square root of the number within the parantheses and return the value to the main program. In this case, the argument is a mere number. In general, it can be a variable or an expression. The computer will first compute the expression inside the argument and use this value for evaluating the square root function.

If the argument has not been defined earlier, the computer will give an error message. The algebraic form and the FORTRAN form of the functions built inside the FORTRAN compiler are shown in Table 8.1. The programs for evaluating these functions are inside the compiler itself. So these functions can be called system defined. Later it will be shown that the user also can define functions for his use in particular programs.

FORTRAN library functions

TABLE 8.1

Algebraic Form	FORTRAN Form
$x^{1/2}$	SQRT(X)
$\lvert x \rvert$	ABS(X)
$\lvert k \rvert$	IABS(K)
e^x	EXP(X)
$\sin x$	SIN(X)
$\cos x$	COS(X)
$\log_e x$	ALOG(X)
$\log_{10} x$	ALOG10(X)
$\tan^{-1} x$	ATAN(X)

The computed values of all these functions except the IABS function will be in the real mode. The arguments of all the functions except the IABS function must be in the real mode. Only the IABS function returns an integer value. In the case of sine and cosine functions, the values of the arguments must be given in the radian measure. If the angle θ is in degrees, it must be converted to radian measure and the argument written as THETA*22.0/(7.0*180.0).

The arguments of the library functions may be either constants or variables or expressions. Of course, the variables occurring in the argument must be defined beforehand, otherwise the computer will give an error message. Defining a variable means assigning a value to it. There may be some more library functions available with a particular machine and they can be ascertained from the manual of that machine.

Converting algebraic expressions to FORTRAN expressions

We have completed all the rules relating to the coding of constants, variables, operators and expressions in FORTRAN. So, theoretically, we must be in a position to convert any algebraic expression into FORTRAN expression. We know that the expression occurs on the right side of a formula and it is only the computed values of such expressions that give us the solutions to problems. Please brush up your mathematics knowledge and the coding rules in FORTRAN and be in a position to convert any algebraic expression into FORTRAN expression. Some examples to illustrate such conversions from algebraic form to FORTRAN form are given below:

Algebraic Form	**FORTRAN Form**
$ax + b$	A*X + B
$ijklm$	I*J*K*L*M
$\sec(x)$	1.0/COS(X)
$\tan(x)$	SIN(X)/COS(X)
$\sinh(x)$	(EXP(X)−EXP(−X))/2.0
$\lvert a \rvert e^x$	ABS(A)*EXP(X)
a^{bc}	A**(B*C)
$(b^2 - 4ac)^{1/2}$	SQRT (B*B−4.0*A*C)
$\sec(\tan^{-1}x)$	1.0/COS(ATAN(X))
2.5^3	2.5**3
2^3	2.0**3
$\pi r^2h/3$	22.0*R*R*H/(7.0*3.0)
$25a/71$	25.0*A/71.0
$\sin^2\theta$	SIN(THETA)**2
$\sin\theta^2$	SIN(THETA**2)
$(a+b)^{1/3}$	(A+B)**(1.0/3.0)

In the last example one must not write the FORTRAN expression as (A+B)**(1/3). Since 1/3 is in the integer mode, it will be evaluated as zero. So the computer will evaluate $(a+b)^0$ which is not what we intend to calculate. The fraction 1/3 must be evaluated in the real mode. So we have to give the fraction as (1.0/3.0).

Library functions in BASIC

There are a large number of library functions in BASIC which lead to both numeric and string values. The introductory para on library functions at the beginning of the article is valid for BASIC. The list of library functions and their meanings are given below:

Function Name	**Meaning**
ABS(X)	Absolute value of x
SQR(X)	Square root of x
SIN(X)	Sine (x), where x is in radian measure
COS(X)	Cosine (x), where x is in radian measure
ATAN(X)	Arc tan of x or tan inverse of x. The function returns the angle in radian measure whose tangent is x.
LOG(X)	Logarithm of x to the Naperian base 'e'
EXP(X)	e^x
INT(X)	Integer part of x
RND(X)	This function will return one random number between 0 and 1.
SGN(X)	Sign of x. This function will return -1 if the argument is less than 0, 0 if the argument is 0 and +1 if the argument is greater than 0.
STR$(X)	This is called string dollar function. This converts the numeric value of x to string. If x is 2345, then STR$(X) becomes "2345".
VAL(X$)	This is called Val function. This function converts the numeric string stored by X$ into the corresponding numeric value. If X$ is "2345", then VAL (X$) is 2345. If X$ is not a numeric string, the VAL function will return zero value.
LEN(X$)	This is called the Len function. This function returns the length of the X$ string in terms of the number of characters in the string. If X$ is "R. KRISHNAN", then LEN(X$) will return 11.
ASC(X$)	This is called Aske function. This function will return the ASCII value of the first character of the X$ string. If X$ is "A", then ASC(X$) will return 65. Similarly, every character will be stored in the form of a number called the ASCII value of that character.
CHR$(X)	This is called Chr dollar function. This function returns the character whose ASCII equivalent value is the integer part of the numeric argument. For example, CHR$(65) will return the character "A". This function does the reverse of the ASC function.
LEFT$(X$,n)	This is called the left dollar func-

	tion. This function returns one or more characters from the left end of the X$ string. If n is 1, then one character will be returned. If n is 2, then two characters will be returned and so on. If X$ is "2345", then LEFT$(X$,1) will return "2", LEFT$(X$,2) will return "23" and so on.
RIGHT$(X$,n)	This is called the right dollar function. This function returns n characters from the right end of the X$ string. If X$ is "2345", then RIGHT$(X$,1) will return "5", RIGHT$(X$, 2) will return "45" and so on.
MID$(X$,m,n)	This is called the mid dollar function. This function returns n characters starting from the mth position of the X$ string. If X$ is "2345", then MID$(X$, 2, 1) will return "3", MID$ (X$, 3, 1) will return "4", MID$(X$, 2, 2) will return "34" and so on.
MATCH(Y$,X$,n)	This is called the match function. This function returns a numeric value. It will search for the occurrence of the Y$ string in the X$ string starting from the nth position of the string and return the position of the occurrence of the string Y$. If Y$ string does not occur in the X$ string starting from the nth position, it will return 0. If X$ is "MISSES", Y$ is "SS" and n is 1, then MATCH(Y$,X$,1) will return 3, MATCH (Y$,X$, 4) will return 0, MATCH (X$, Y$,2) will return 2 and so on.

There may be some more library functions available with a particular machine and they can be ascertained from the manual of that machine. BASIC does not make distinction between reals and integers as FORTRAN does. All computations are done in the real mode. If one wants integer arithmetic to be done, the item must be converted to integer mode using the INT function. The following examples illustrate the conversion of some algebraic expressions to the BASIC form:

Algebraic Form	**BASIC Form**
$ax+b$	A*X+B
$ijklm$	I*J*K*L*M
$\sec(x)$	1/COS(X)
$\tan(x)$	SIN(X), COS(X)
$\sinh(x)$	(EXP(X)-EXP(-X)) 2
$\lvert a\rvert e^{x}$	ABS(A)*EXP(X)
a^{bc}	A∧(B*C)
$(b^2-4ac)^{1/2}$	SQR(B*B-4*A*C)
$\sec(\tan^{-1}x)$	1/COS(ATAN(X))
2.5^3	2.5∧3
2^3	2∧3
$\pi r^2h/3$	22*R*R*H/(7*3)
$25a/71$	25*A/71
$\sin^2\theta$	SIN(THETA)∧2
$\sin\theta^2$	SIN (THETA∧2)
$(a+b)^{1/3}$	(A+B)∧(1/3)

In a similar manner one can convert any algebraic expression to the BASIC form.

Library functions in PL/1

There are a number of library functions or built-in functions in PL/1 also which can be used without any prior declaration in a program. The list of library functions and their meanings are given below:

Library Functions	**Meaning**
SIN(X)	Returns the sine of x, where x is in radian measure. Result is in float binary (real in scientific notation)
COS(X)	Returns the cosine of x, where x is in radian measure. Result is in float binary (real in scientific notation)
LOG(X)	Returns the natural logarithm of x in float binary
ATAN(X)	Returns arc tan(x) or $\tan^{-1}x$ in float binary radian measure.
EXP(X)	Returns the value of e to the power x in float binary
ABS(X)	Returns the absolute value of x
CEIL(X)	Returns the smallest integer greater than or equal to x. If x is 1.2, CEIL(X) is 2 and if x is -1.2, CEIL(X) is -1
FLOOR(X)	Returns the greatest integer less than or equal to x. If x is 1.2, FLOOR(X) is 1 and if x is -1.2, FLOOR(X) is -2
MAX(X, Y)	Returns x if x is greater than or equal to Y, otherwise returns Y
MIN(X, Y)	Returns x if x is less than or equal to X, otherwise returns Y
MOD (X, Y)	Returns the value of x mod y. If x and y are integers, then x mod y gives the reminder when x is divided by y. If y is equal to 0, then x is returned. Otherwise it returns X-ABS(Y)*FLOOR(X/ABS(Y)), e.g., MOD(7, 3) is 1 MOD(-7, 3) is 2 MOD(7,-3) is 1 MOD (-7,-3) is 2
ROUND(X, K)	Returns x rounded to K digits to the right of the decimal point. If K is less than 0, then x is rounded of to K digits

	to the left of the decimal point, e.g., ROUND(12345.24689,3) returns 12345.24700 ROUND(12345.24689,-3) returns 12000.00000
TRUNC(X)	Returns the integer portion of x. If x is less than 0 returns CEIL(X) and if x is greater than or equal to zero, then returns FLOOR(X), e.g., TRUNC(52.146) is 52 TRUNC(-52.146) is -52
SIGN(X)	Returns –1 if x is less than 0, returns 0 if x is equal to 0, returns +1 if x is greater than 0
SQRT(X)	Returns the square root of x in float binary

There may be some more library functions depending on the machine and the same can be referred to from the manual of the particular machine. In forming expressions, integers and reals can be mixed as in the case of BASIC, but precision errors are likely to occur because every variable is declared in the beginning. Suppose A and B are declared as integers whose values are 2 and 3 respectively, and C is declared as real, and if one writes C=B/A, one will get an answer 1.0.

In PL/1 all calculations are done in float binary (i.e. real in the scientific notation). The final result can be given either in floating notation or exponent notation. Some of the rules relating to actual computation vary from machine to machine and so it is advisable to refer to the manual of that machine while trying to do arithmetical simplifications.

Library functions in PASCAL

The following standard functions or library functions are available in PASCAL:

Function Coded as	Argument Type	Result Type and Meaning
ABS(I)	Integer	Absolute value of integer given in the integer mode, e.g., ABS(–4) is 4
ABS(R)	Real	Absolute value of real given in the real mode, e.g., ABS(–3.4) is 3.4
SQR(I)	Integer	Square of integer given in the integer mode, e.g., SQR(2) is 4
SQR(R)	Real	Square of real given in the real mode, e.g., SQR(4.0) is 16.0
TRUNC(R)	Real	Integer part of real when R is real. It is used to convert real to integer, e.g., TRUNC(4.5) is 4
ROUND(R)	Real	It rounds the number to the nearest integer, e.g., ROUND(1.2) is 1 and ROUND(1.8) is 2
SIN(R)	Real or integer	Sine of the angle given in radian measure. Result is real irrespective of the mode of the argument
COS(R)	Real or integer	Cosine of the angle given in radian measure. Result is real irrespective of the mode of the argument
ARCTAN(R)	Real or integer	The inverse of the tangent of the argument in radians in the real mode irrespective of the mode of the argument
LN(R)	Real or integer	Natural logarithm of the argument in the real mode irrespective of the mode of the argument
EXP(R)	Real or integer	Exponential of the argument, e^r, in the real mode irrespective of the mode of the argument
SQRT(R)	Real or integer	Square root of the argument in the real mode irrespective of the mode of the argument

Coding of algebraic expressions in PASCAL

The following examples illustrate the coding of algebraic expressions in PASCAL form:

Algebraic Form	PASCAL Form
$ax+b$	A*X+B
$ijklm$	I*J*K*L*M
$\sec(x)$	1/COS(X)
$\tan(x)$	SIN(X)/COS(X)
$25/71$	25 DIV 71 or 25/71 depending on whether integer arithmetic or real arithmetic is required to be done
x^2	SQR(X) or X*X
a^b	EXP(B*LN(A))
$(b^2-4ac)^{1/2}$	SQRT(B*B – 4*A*C)
$\sin^2\theta$	SQR(SIN (THETA))
$\sin\theta^2$	SIN(SQR(THETA))
$\sinh(x)$	(EXP(X) – EXP(–X))/2
$\sin^{-1}x$	ARCTAN(X/SQRT(1–X*X))
$\cos^{-1}x$	ARCTAN (SQRT(1–X*X)/X)
a^{bc}	EXP(B*C*LN(A))
$pnr/100$	P*N*R/100
$p(1+r/100)^n$	P*EXP(N*LN(1+R/100))

The main function of a computer is to compute the value of an expression which is coded in a high-level language. We know that the right hand side of a formula always contains an expression. So, by computing an expression, the computer will be able to get at the solution of a problem. Thus it is clear that a major task in learning a computer language is achieved when one is able to convert any algebraic expression into the corresponding computer language expression.

What remains is to convert this into complete instructions. Complete instructions are given in the form of statements. From the next lesson onwards we will start studying the different types of statements used to give different instructions to the computer.

(To be continued next month)

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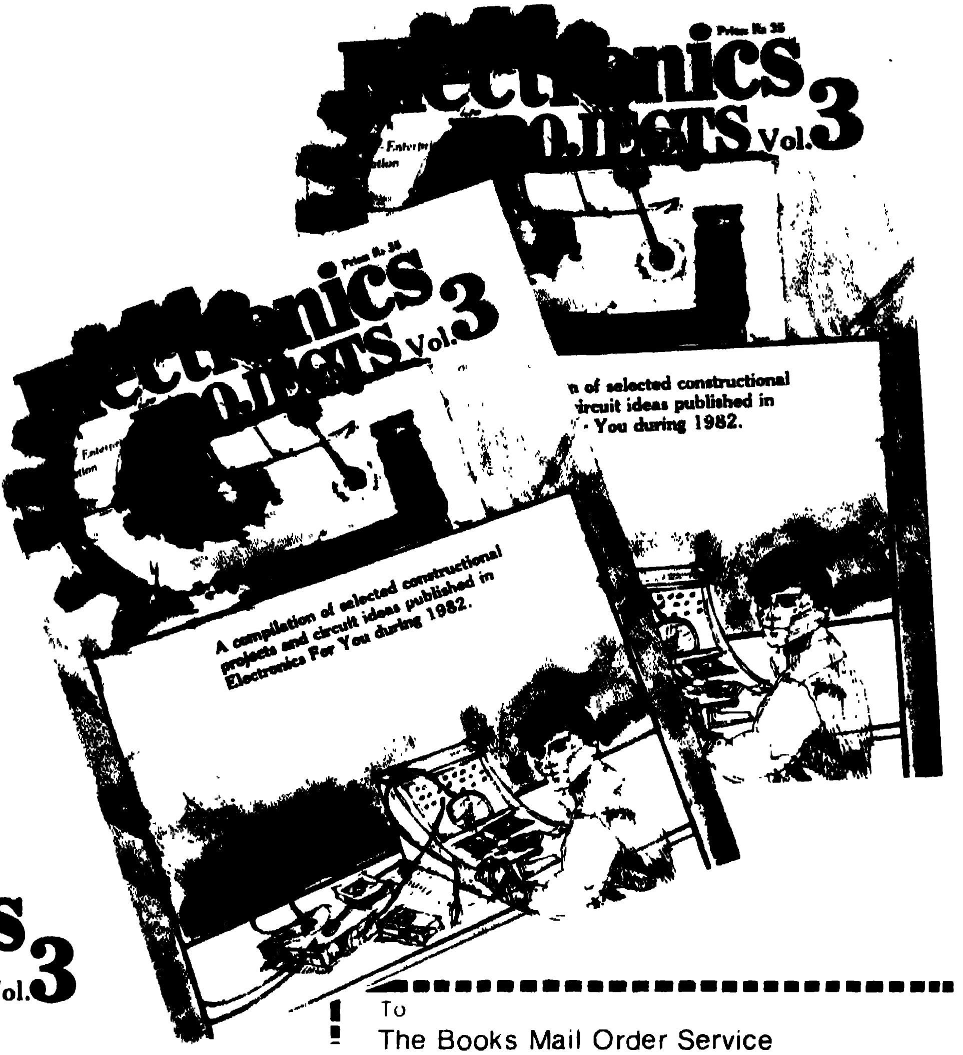
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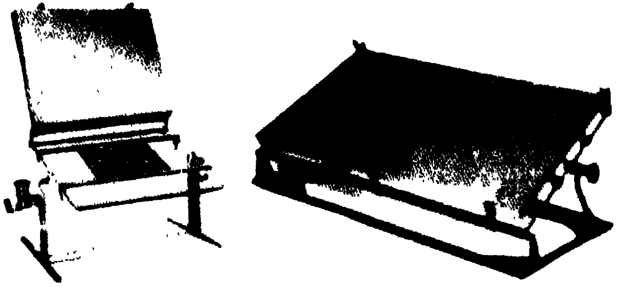

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IS 4	ISFL 4	325 x 550

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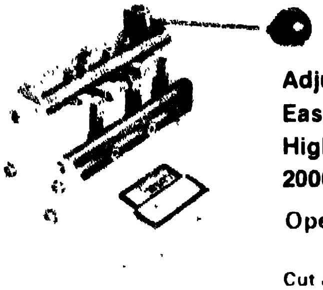

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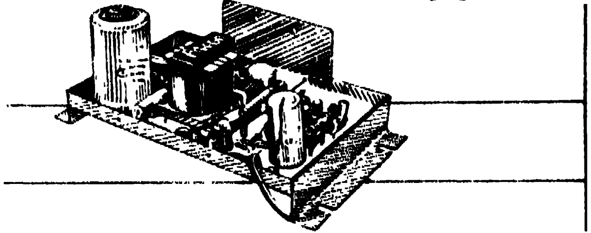

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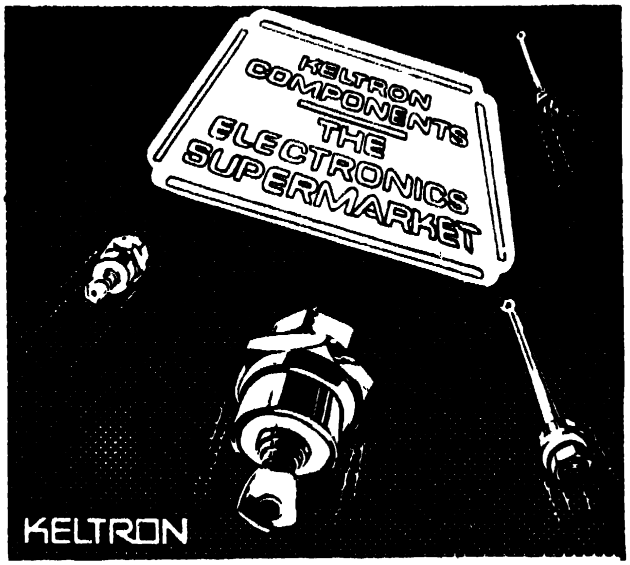

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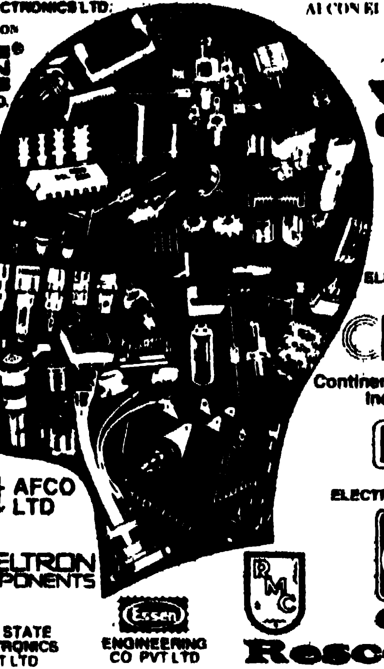

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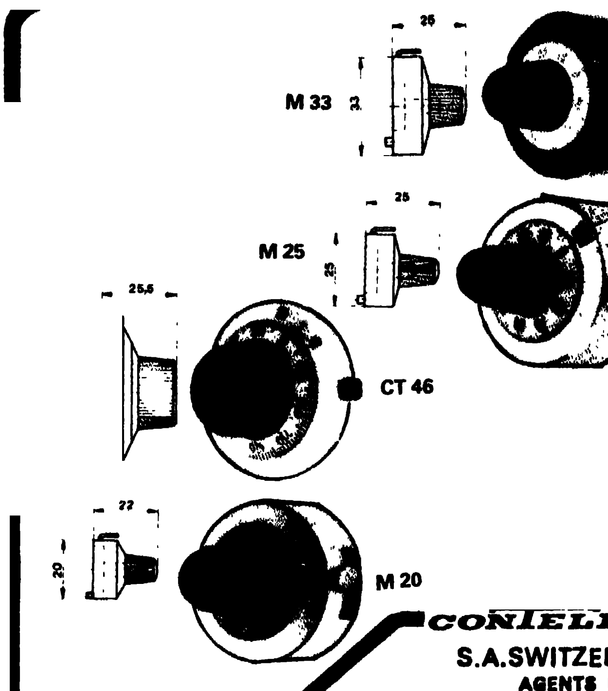

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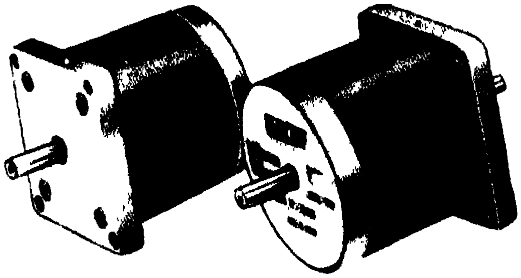

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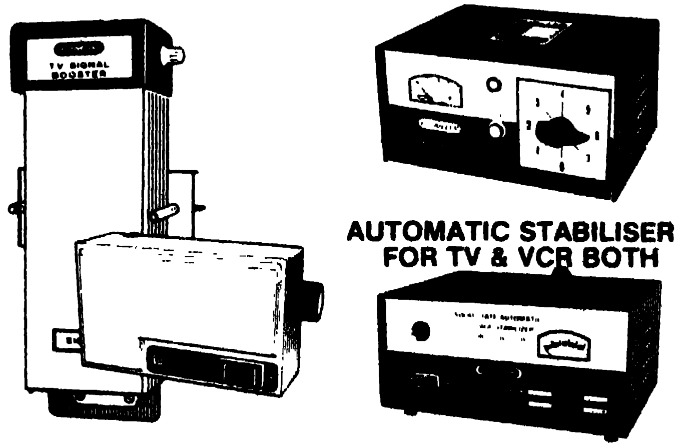

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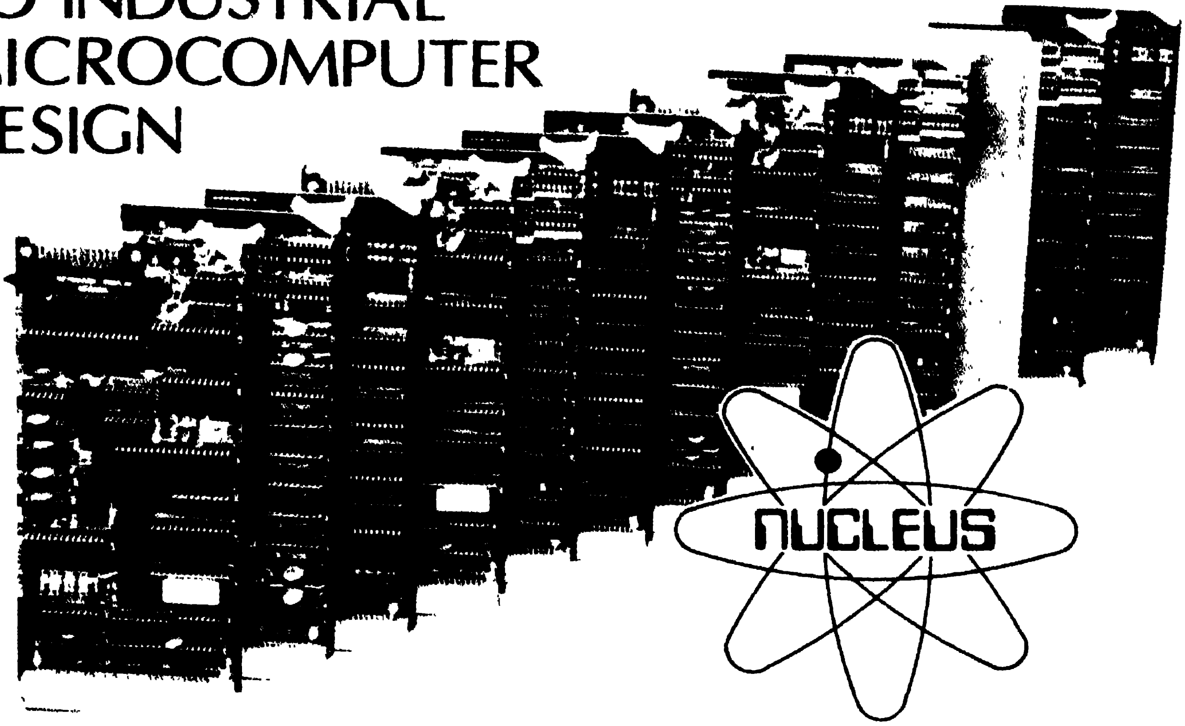

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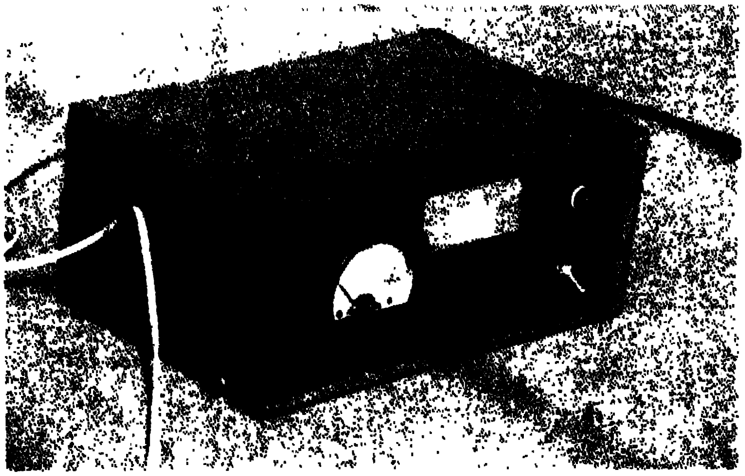
Solidstate Automatic AC Voltage Regulator



Balakrishna P.

Maintaining constant voltage is very difficult. This problem can be solved by using automatic voltage stabilisers. Although a number of automatic voltage regulators are available in the Indian market and are advertised as solidstate automatic voltage regulators, most of them cannot be said to be true solidstate devices.

Invariably, the voltage level sensing circuits in these automatic voltage regulators are of solidstate design but the controlling elements are usually relays or motor driven variacs which are actually mechanical devices. This article will describe how to design and fabricate a 'true' solidstate automatic voltage regulator, without a single moving element in its circuitry.

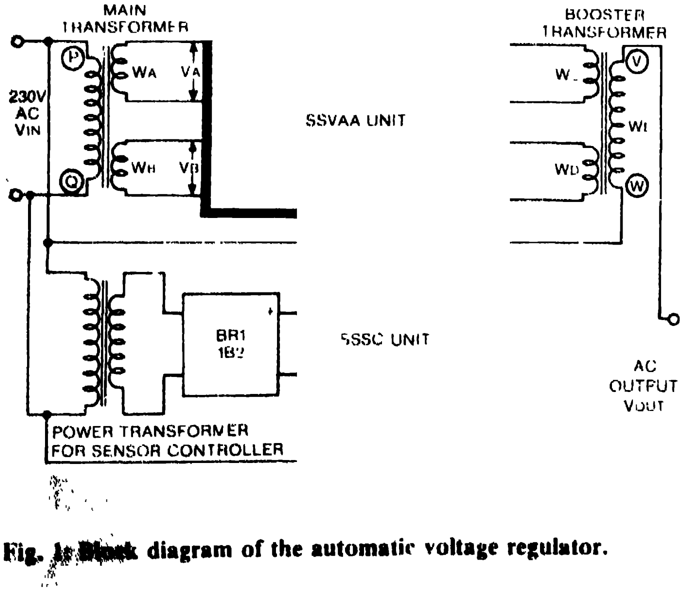


Fig. 1: Block diagram of the automatic voltage regulator.

Boosting principle

As shown in Fig. 1, the incoming line voltage, V_{IN}, is stepped down to voltages V_A and V_B at the secondary windings W_A and W_B respectively of the input transformer. The booster transformer has two primary windings, W_C and W_D, connected to the SSVAA (solidstate variable amplitude amplifier), which drives it in accordance with the control signals obtained from the SSSC (solidstate sensor and controller). One of the terminals of the secondary windings of the booster transformer is connected to the input and the other forms one of the output terminals. Another output terminal is taken from the input, to which the secondary of the booster transformer is not connected.

The input voltage is stepped down, rectified and the DC voltage is fed to the SSSC which detects the variations in the input voltage and provides the required correction control signal to the SSVAA.

Working of the SSVAA unit

This unit, as shown in Fig. 2, consists of two power transistors T1 and T2; four diodes D1, D2, D3 and D4; and three resistors VR1, R4 and R6. R4 is a light-dependent resistor

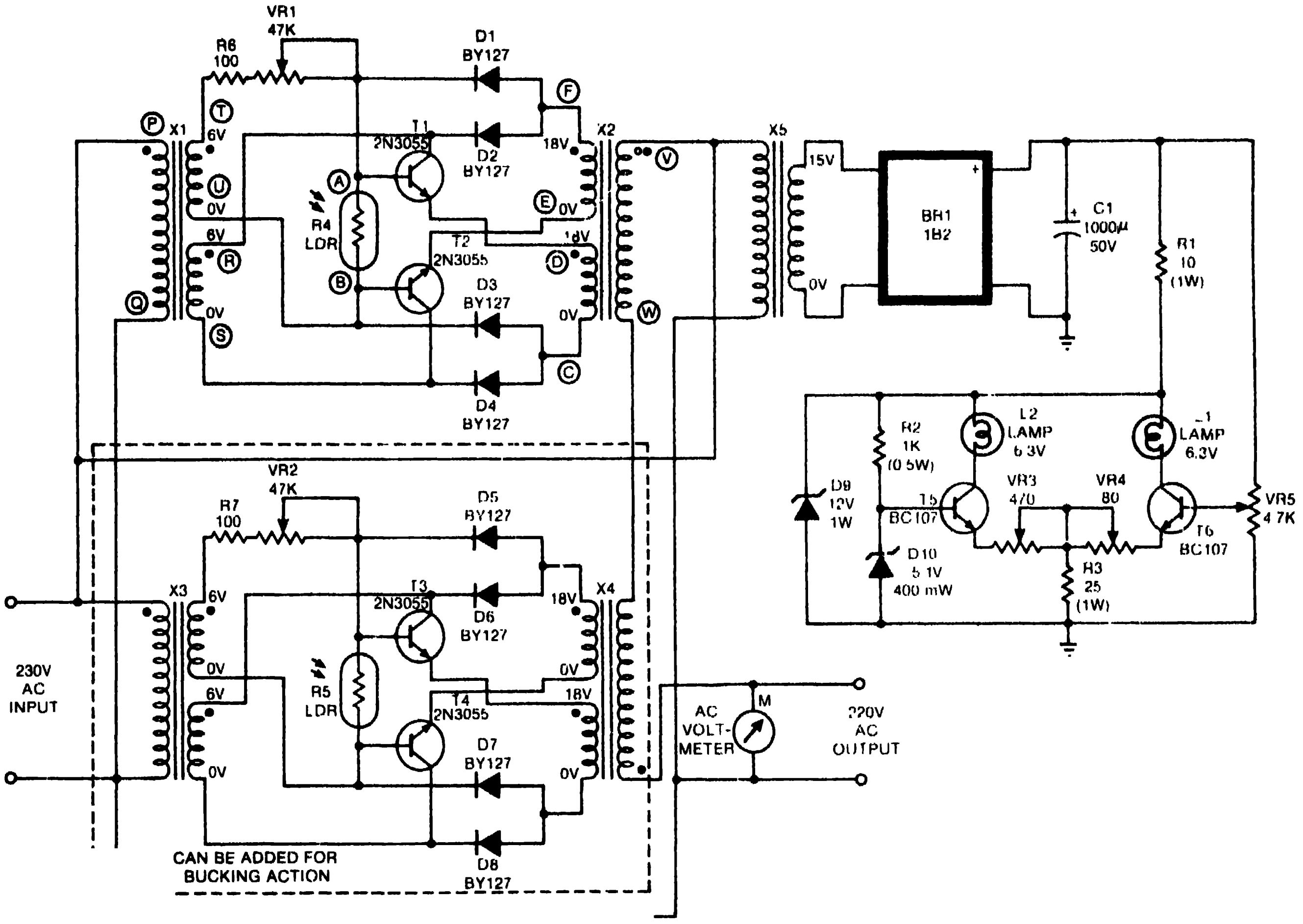


Fig. 2: Circuit diagram for solidstate automatic voltage regulator.

PARTS LIST

Semiconductors:		
T1-T4		2N3055 npn power transistor
T5, T6	—	BC107 npn transistor
D1-D8	--	BY127 rectifier diode
D9		12V, 1-watt zener diode
D10		5.1V, 400mW zener diode
BR1	—	1B2, 1-amp bridge rectifier diode
Resistors (all ¼watt ±5% carbon, unless stated otherwise)		
R1		10-ohm, 1-watt
R2		1-kilohm, 0.5-watt
R3		25-ohm, 1-watt
R4, R5	--	100-ohm
R6, R7	—	LDR (light dependent resistor)
VR1, VR2	—	47-kilohm potentiometer
VR3		470-ohm potentiometer
VR4		80-ohm potentiometer
VR5	--	4.7-kilohm potentiometer
Capacitor:		
C1		1000µF, 50V electrolytic
Miscellaneous:		
X1, X3		230V primary to two 0-6V, 1-amp secondary transformer
X2, X4	--	Two 0-18V primary to 230V, 2-amp secondary transformer
X5		230V primary to 15V, 1-amp secondary transformer
L1, L2	--	6.3V, 0.3-amp lamp
	---	PCB, heatsink for power transistor, AC voltmeter, 7/36 flexible wire, suitable enclosure, screws, nuts, washers etc.

(LDR). The resistance value of the LDR is inversely proportional to the incident light on its active surface.

The circuit is a special form of 'class B' emitter follower amplifier with the collector supply fed from an AC source instead of conventional DC supply. Since the various windings have to be connected in a particular phase relationship, at any instant when point P is positive with respect to point Q at the input of the mains transformer X1, points R, T and V will be positive with respect to points S, U and W in windings W_B, W_A and W_F as shown in the block diagram.

Considering such an instant, winding W_A drives a current through R6 and VR1. This current produces voltage V_C across the terminals A-B of the LDR. From the above assumption of polarity, point 'A' of this voltage will be positive with respect to 'B' and cause a base current to flow through the transistor T1, along the path A-D-C-B-A and on account of this base current drawn from winding W_B, along the path R-T1-D-C-S-R.

The above explanation covers half a cycle when point P is positive with respect to Q. At the end of this half cycle, during the period of zero crossing, the voltages V_C, V_A and V_B are all equal to zero after which the negative half cycle commences. During the negative half cycle, point 'B' becomes positive with respect to point 'A' and thus diode D3

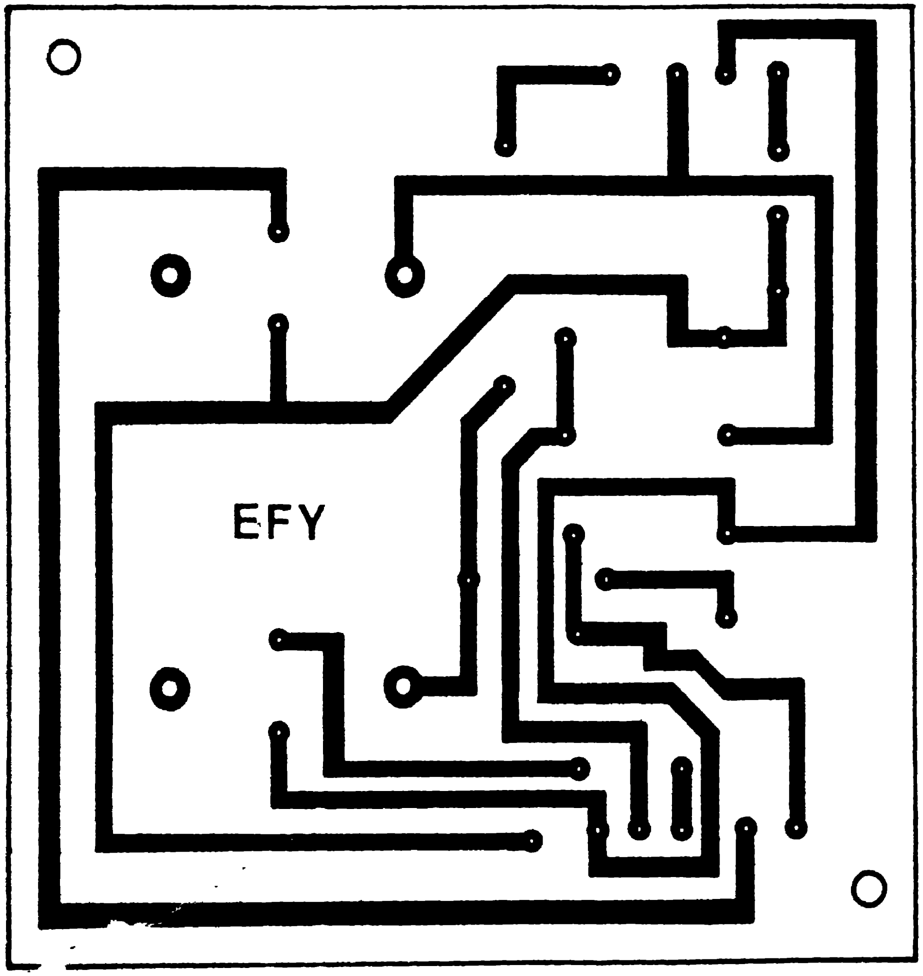


Fig. 3: Actual size PCB layout for variable amplitude amplifier.

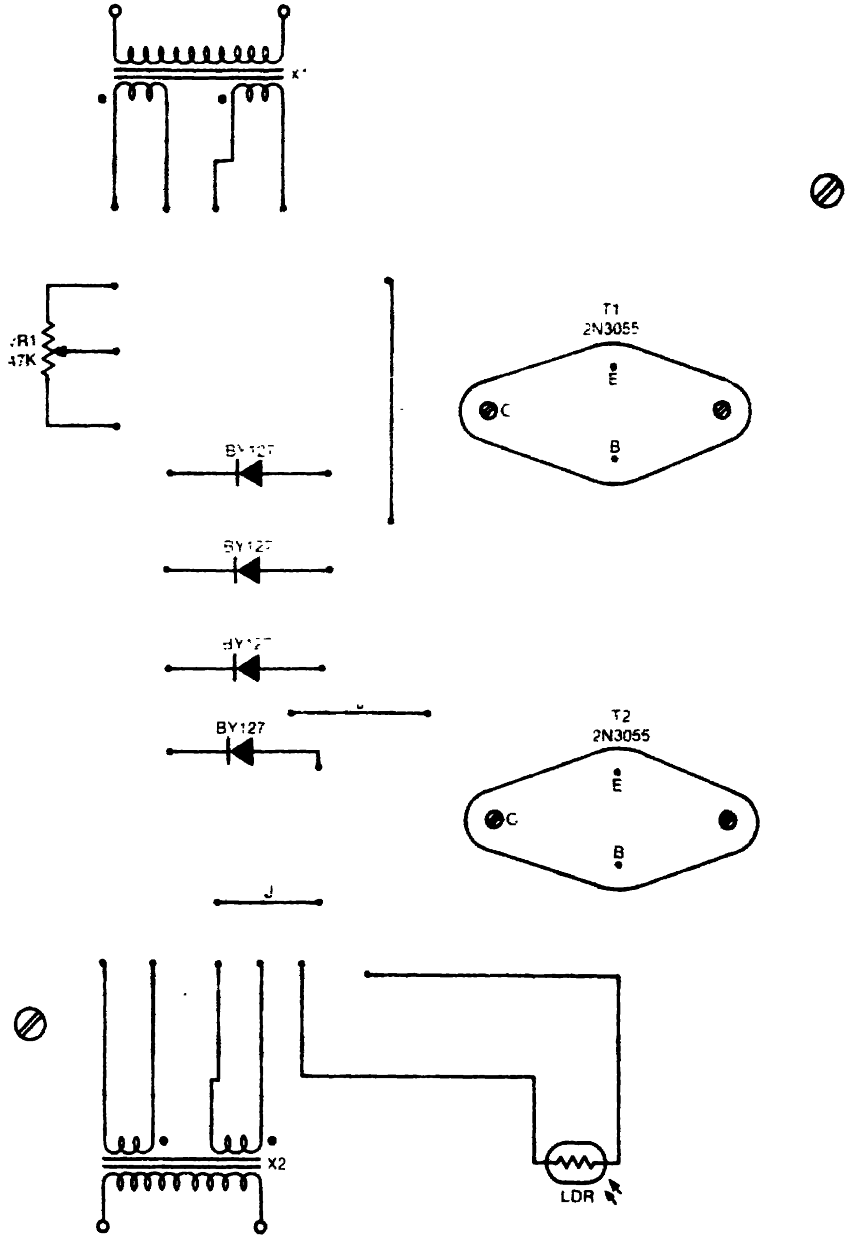


Fig. 4: Component layout for the PCB.

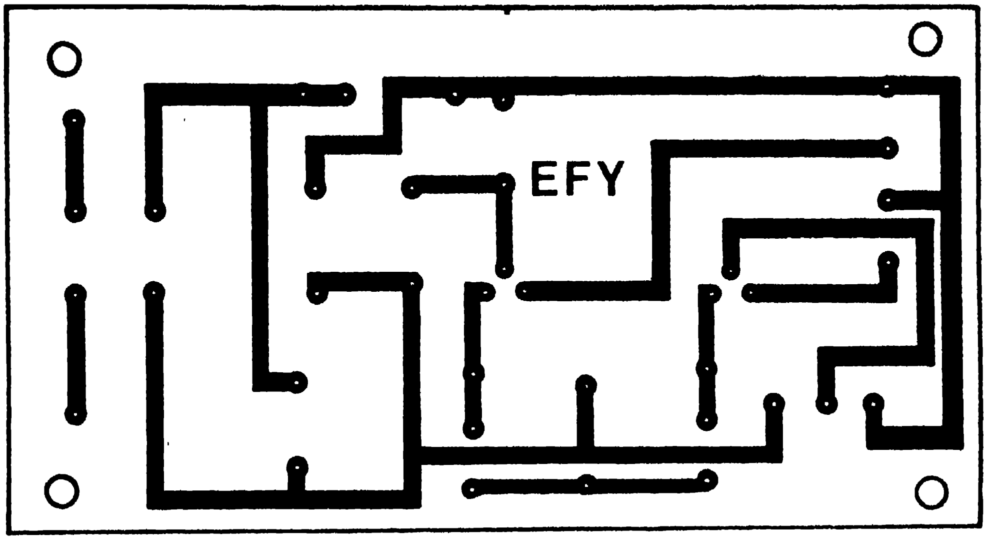


Fig. 5: Actual size PCB layout for the sensor and controller.

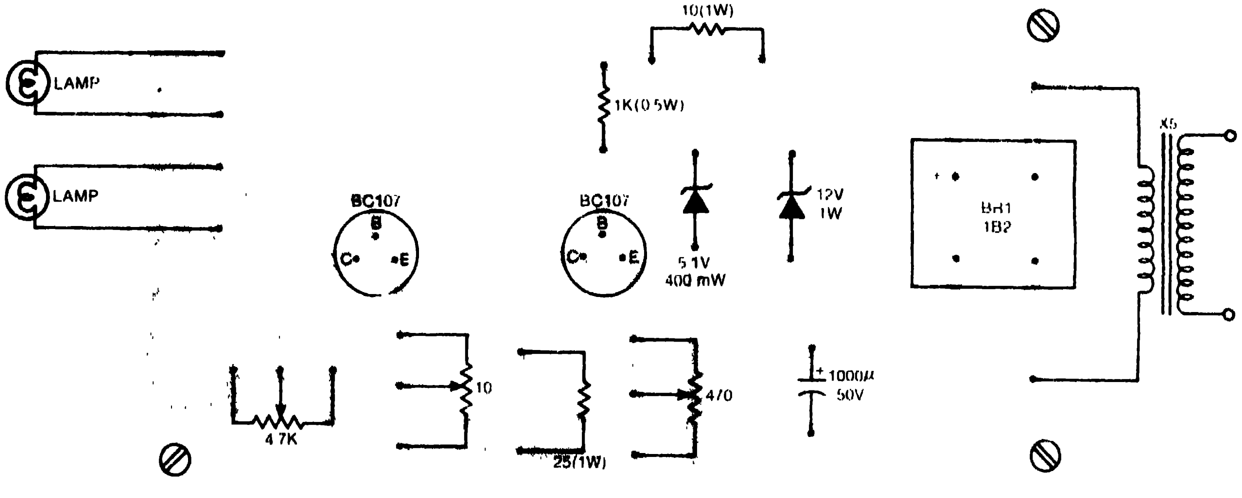


Fig. 6: Component layout for the PCB.

blocks any current through W_D. But a base current flows through transistor T2 and winding W_C causing a collector current along the path S-T2-E-F-R-S.

Solidstate sensor and controller

The input for the SSSC is obtained directly from the supply voltage through a stepdown transformer X5 and a bridge circuit used for sensing and controlling the variations in the supply is a differential amplifier.

Transistors T5 and T6 are connected (as shown in Fig. 2) so as to obtain a differential amplifier configuration at normal AC voltage of 230 volts. The potentiometer VR5 (4.7k) is adjusted to obtain maximum brightness of the lamp. When the input AC voltage decreases, the voltage applied to the base of T6 decreases. This causes a decrease in the collector current of T6 and thus a decrease in the brightness of the lamp. This will cause an increase in the resistance of the LDR which in turn increases the voltage applied to the primary of transformer of SSVAA whose secondary will 'boost' the output to the normal value. The LDR and the lamp must be enclosed in a light impermeable capsule.

The circuit described boosts the voltage in case it goes below the normal value. But in case the voltage goes above normal, bucking action can also be incorporated.

The circuit for incorporating the bucking action using T3 and T4 is shown in Fig. 2. The secondary of output transformer of the boosting unit is in phase with the input, whereas the secondary of the output transformer of the bucking unit is connected in phase opposition. Both the secondaries are connected in series. The dots marked over the windings of transformer in Fig. 2 represent the polarity of the windings of transformers.

The voltage across the LDR (R4) of the boosting unit is controlled by lamp L1 whereas LDR (R5) is controlled by lamp L2. The output volt-amp, can be varied by varying the current rating of the secondary winding (W_F) of transformer X2.

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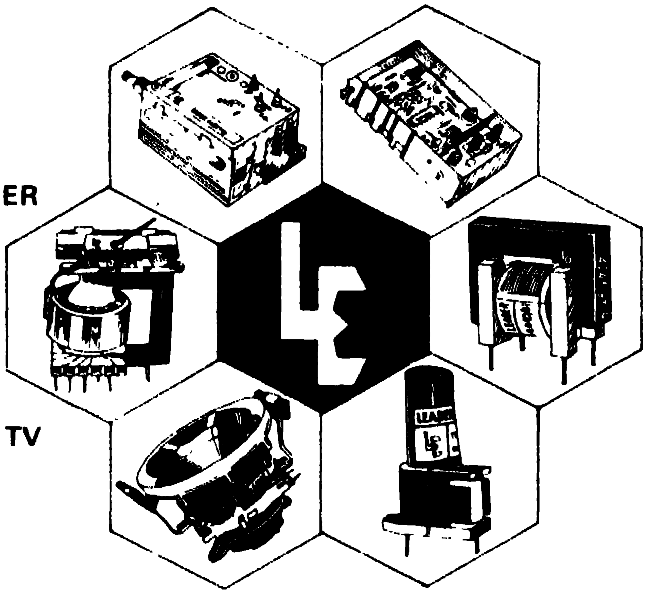

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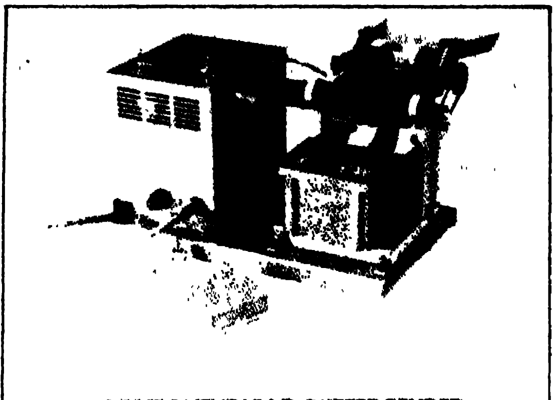

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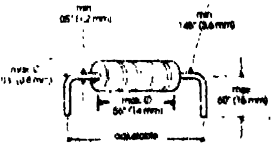

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This device permits feeding and forming of loose components Can be used with the CB-1 manual lead bender alone or with the CB-1 and CB-3 electric motor. The operator moves the components from the master tray into the catch trough, concentric rollers sort, pick up, center and deposit parts on preset, cut and bend mechanisms Will accommodate components as long as 3 9 inches (98 mm) overall.

D=0 09"-0.26" (2 3-6.5 mm)
K=0 16"-1 00" (4-25 mm)
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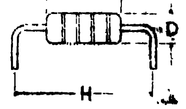

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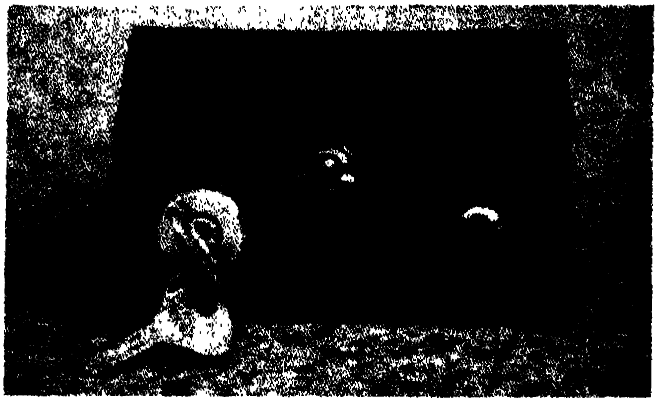

STD/Local Bar to Prevent Overcharging

P. Jayavardhana Krishnan

Overcharging of telephone bills is not an uncommon occurence in India. Often in offices, business houses and even at homes, telephone subscribers are faced with unbelievably inflated bills. In spite of taking certain precautions, subscribers have not been freed of this menace.

Many attempts have been made and devices developed to arrest overcharging of bills. One such device is described in this article.

This device when switched to STD OFF, LOCAL OFF position, disables the telephone from STD and local dialling facility, when switched to STD OFF, LOCAL ON position disables the telephone from STD facility but enables the telephone for local dialling and when switched to STD ON, LOCAL ON position enables the telephone for both the STD and local dialling. Thus STD and local facilities can be turned on or off as and when required and use of the instrument in proxy can be avoided which may cut overcharging considerably.

However, this device does not interrupt incoming calls. It can be connected to any type of telephone instrument, either pushbutton type or dial type. The connections to this device are also simple. Just connect the incoming line from exchange to the terminals marked INPUT of this device and OUTPUT to the telephone instrument with proper polarities.

This device is allowed by the P and T Department. However, readers are advised to get the prior permission of the telephone authorities before assembling the device.

The circuit

This device is designed around CMOS IC for increased longevity of the battery. The heart of the circuit is the synchronous decade counter/decoder IC CD4017. It counts the number of positive going pulses received at its clock input and provides a high output on its decimal decoded outputs (DDO) corresponding to the decimal equivalent of the former.

IC CD4093B is a quad two input NAND schmitt trigger with UTP (upper triggering point) about 6V and LTP (lower triggering point) about 4V. This IC is used to shape the pulses received from the telephone instrument during dialling to meet the clock pulse requirements of IC2 for its reliable operation.

Zener D5 is used to isolate gate 1 of IC1 from the battery of exchange during inter-digital pause and during dial-tone. Whenever a number is dialled, D1 and D5 conduct and the voltage at the input of gate 1 goes well above UTP.

Gate 2 inverts output of gate 1. C1 prevents Vin from going below LTP during inter-pulse period of dialling. Thus, whenever a number is dialled, a positive going pulse appears

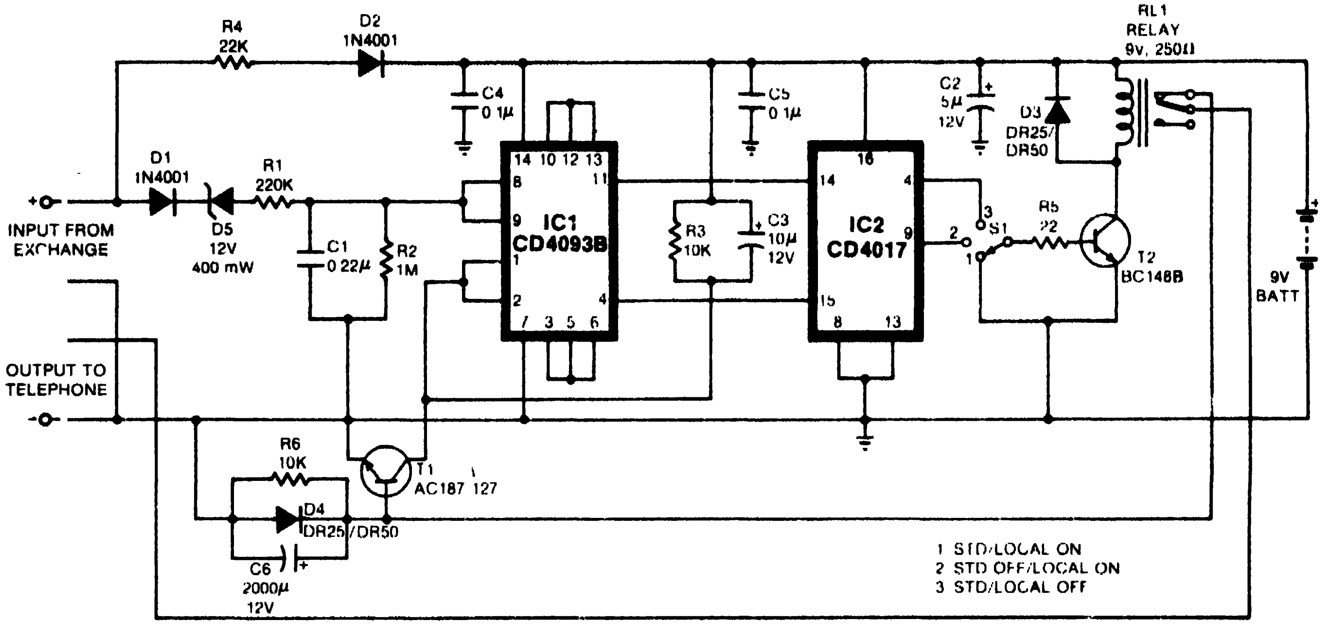

Fig. 1: Circuit diagram of STD/Local Bar.

PARTS LIST

Semiconductors:	
IC1	CD4093B quad 2-input NAND gates
IC2	CD4017 decade counter
T1	AC187/AC127 npn germanium transistor
T2	BC148B npn silicon transistor
D1, D2	1N4001 rectifier diode
D3, D4	DR25/DR50 germanium diode
D5	12V, 400mW zener diode
Resistors (all ¼watt, ±5% carbon):	
R1	220-kilohm
R2	1-megohm
R3, R6	10-kilohm
R4	22-kilohm
R5	22-ohm
Capacitors:	
C1	0.22µF ceramic disc
C2	5µF, 12V electrolytic
C3	10µF, 12V electrolytic
C4, C5	0.1µF ceramic disc
C6	2000µF, 12V electrolytic
Miscellaneous:	
S1	3-way auto ignition switch
RL1	9V, 250-ohm relay
BATT.	9-volt, Eveready 216 battery
	PCB, IC sockets, enclosure, banana socket, connecting cable, flexible wires etc.

at the clock input (pin 14 of IC2), thereby advancing the counter output by one decimal number. The time constant R2 C1 is so chosen that during inter-digital pause Vin falls below LTP and clock input of IC2 becomes high, thus facilitating the operation of IC2 for the next digit of telephone number.

T1 is used for resetting the counter. Whenever the cradle switches are pressed, base-bias to T1 is removed and reset terminal of IC2 goes high after a short delay (due to time constant R3 C3) which is used to prevent resetting of IC2 to zero during dialling, ultimately resetting IC2 to zero.

In India, the minimum total number of digits for STD is 8: Hence when this device is switched to STD OFF, LOCAL ON position, upon the dialling of 8th digit, DDO Q8 of IC2 goes high which in turn energises the relay. The relay then disconnects the telephone temporarily for a few seconds and again connects it to the exchange after IC2 is reset to zero due to removal of bias to T1. Since this operation is similar to the operation performed by cradle switches, dial-tone is heard on the ear-piece.

One may think that this operation may be performed at the lower digits of the telephone number itself. But this is not possible in the STD OFF, LOCAL ON position since the telephone is barred for local calls too for cities like Bombay and Delhi which have as many as 7 digits for the local numbers.

In STD OFF, LOCAL OFF position, similar operation would take place when the second digit of telephone number is dialled.

In the STD ON, LOCAL ON position T2 will be completly isolated from IC2, thereby enabling the subscriber to dial without any bar. During incoming calls every ring generates a pulse to appear at the clock input of IC2 but during interruption of the ring, DC on the telephone line is absent, T1 is cut-off and so IC2 is reset to zero. Thus during the incoming calls, the maximum pulse possible is one, which is well below the required number of pulses for the operation of this device.

D2 in series with R4 trickle charges the battery used to improve its working life. C4 and C5 are the decoupling capacitors which must be mounted close to pins 14 and 16 and ground terminals of IC1 and IC2 respectively. C6 provides sufficient delay for the release time of relay so that the exchange switching systems reset and restore the dial-tone.

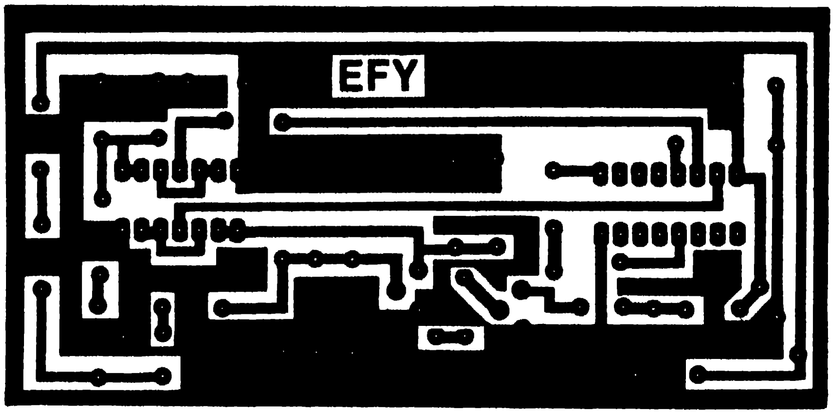

Fig. 2: Actual Size PCB layout for STD/Local Bar.

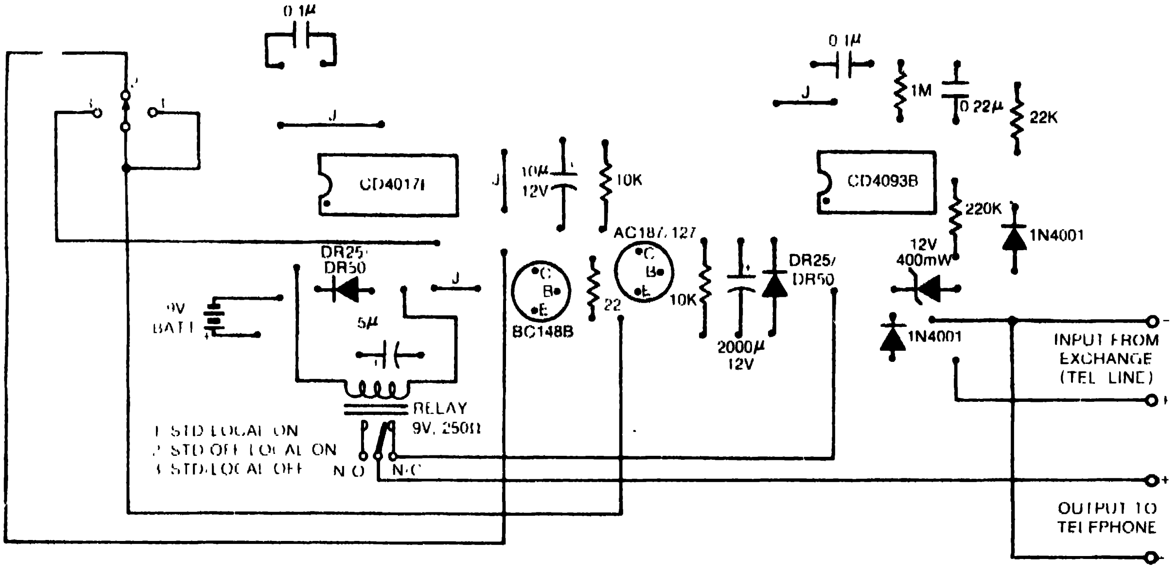

Fig. 3: Component layout for the PCB.

Construction

The prototype is assembled in a general-purpose IC board. However, the suggested PCB pattern is also given here. For switch S1, an automobile ignition switch with three positions is used. Such a switch proves useful because it may be put in the position desired and the key removed. The prototype is housed in a verobox of size 154(L) × 85(W) × 40(H) mm and battery of type Eveready 216 is used. ☐

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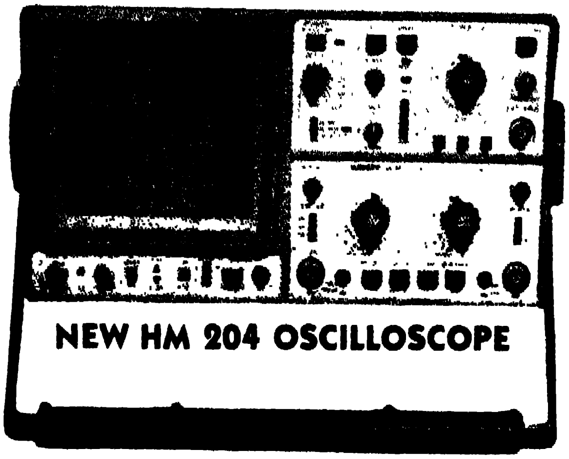

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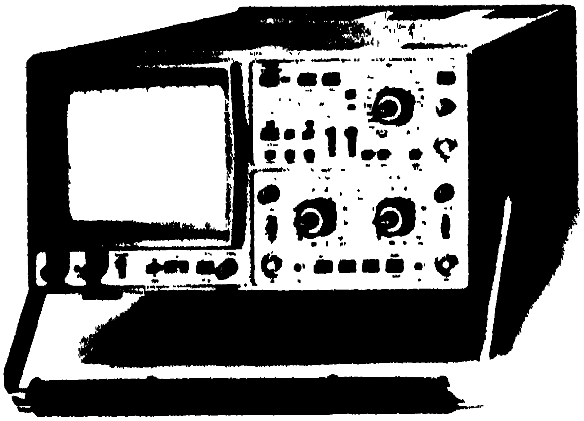

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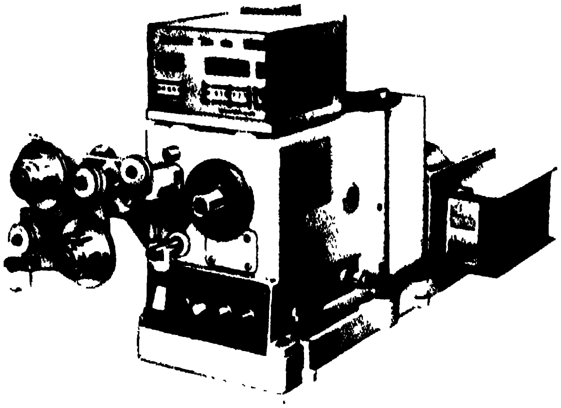

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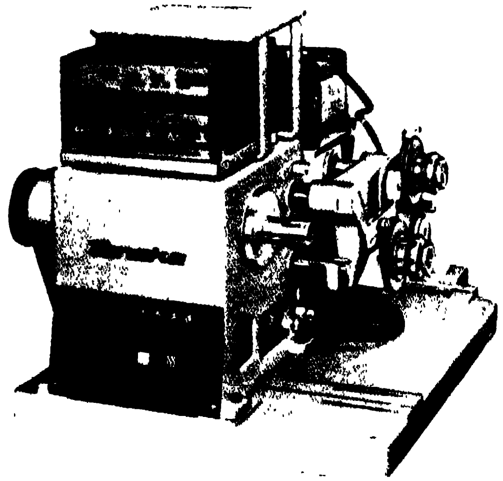

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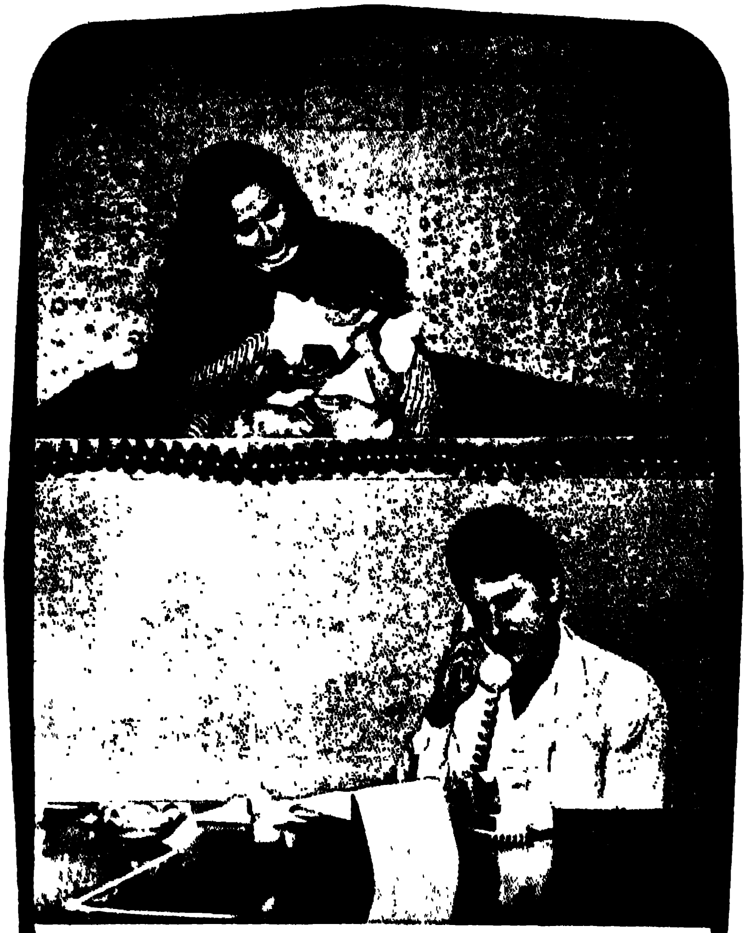

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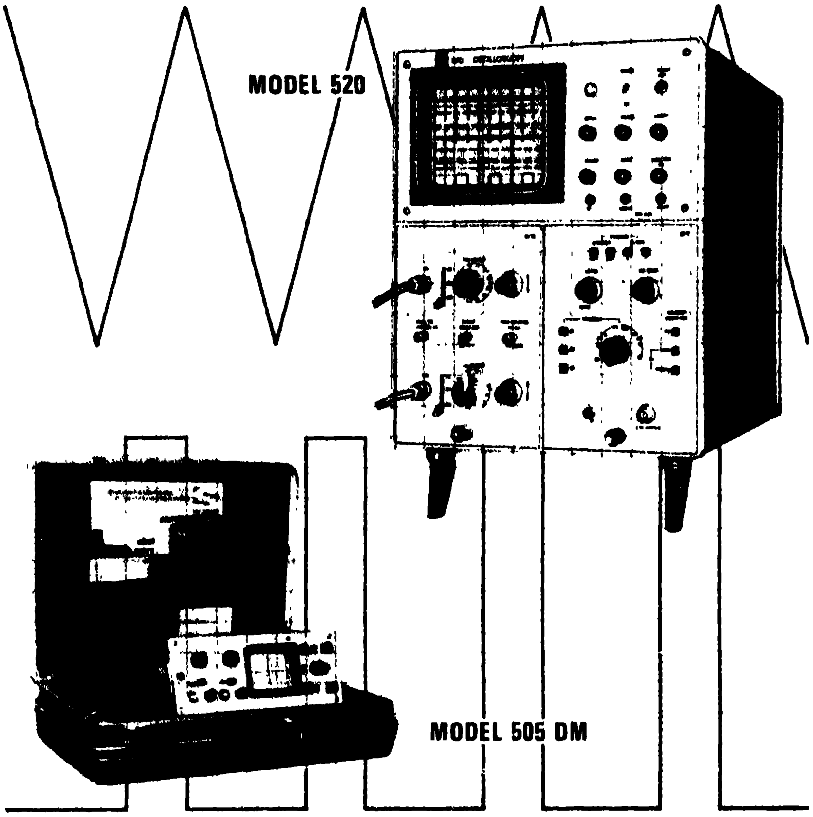

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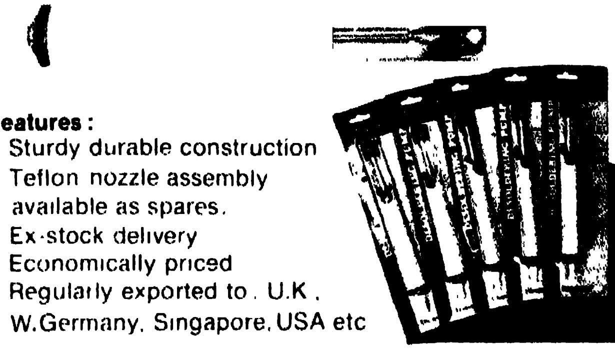

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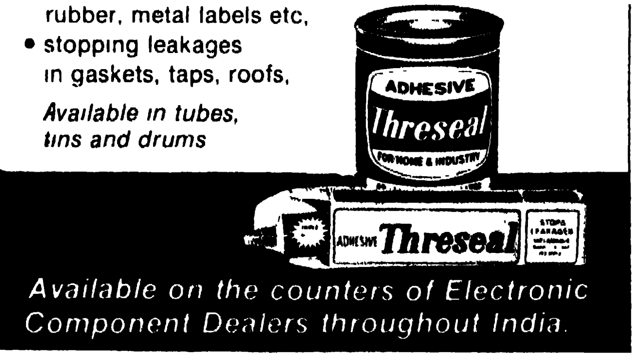

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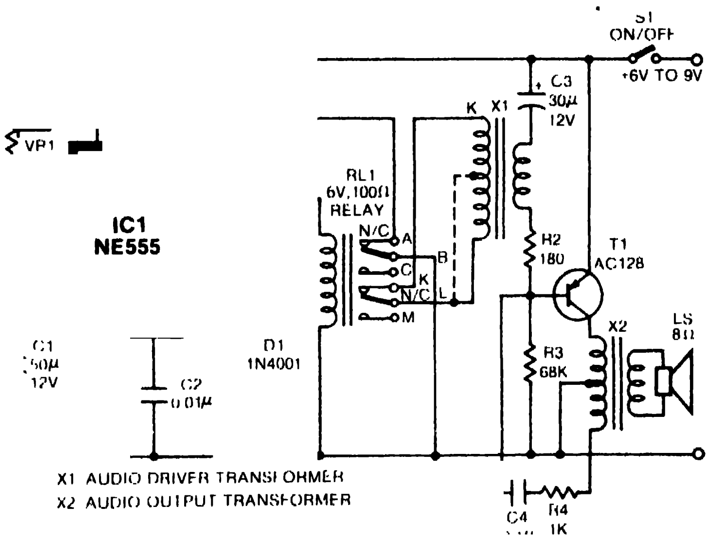
Bird Sound Generator with Timer

Most people have heard parrot bell or bird bell. It produces sound as that of parrot repeatedly. The circuit described here uses a timer along with the 'parrot' circuit to produce a very pleasing sound, as that of parrot or bird. Repetition rate of sound is automatically varied due to the timer circuit. This circuit will cost about Rs 50 only. Power consumption for this circuit is 15 mA at 6 volts.



Pin 2 of IC 555 is connected to relay RL1's terminal A Terminal B of the relay is connected to ground, and relay terminals K and L are connected to two opposite terminals of the driver transformer X1.

As soon as switch S1 is pressed, relay operates for particular time interval. This opens the opposite two terminals of the driver transformer and changes repetition rate of sound of the parrot bell. After one to three seconds, the relay will be in off state and thus short the two terminals of driver transformer and again change the repetition rate of sound of the parrot bell circuit. Preset VR1 may be adjusted for a variation in the sound

Repetition rate can be changed as per choice by replacing capacitor C3 with another value. The effect of using center terminal of driver transformer should also be observed.

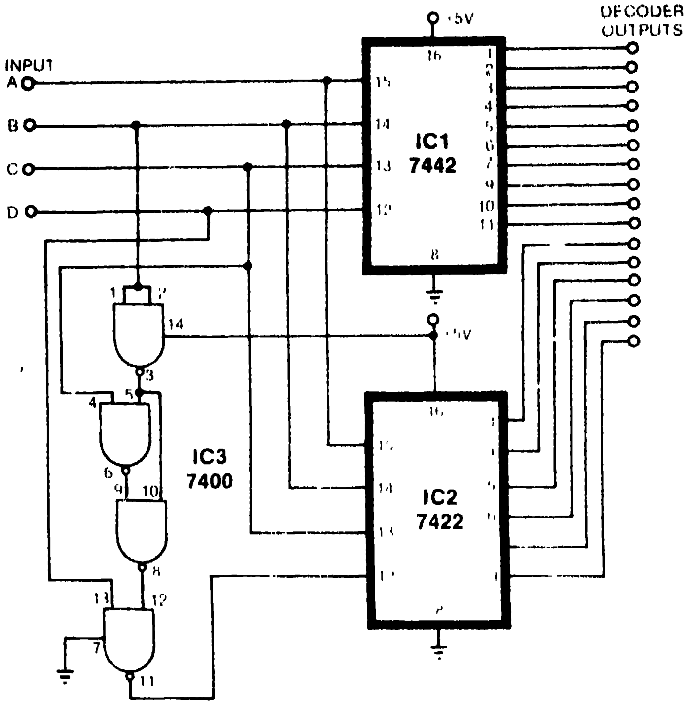
(During evaluation of the circuit in EFY lab, it was observed that changing the value of C3 to 100µF and connecting a 68-ohm resistor in series with the speaker produced a 'real' parrot sound. And repetition rate of the sound changes with slight variation in DC supply voltage.)

PROF. R.V. DHEKALE

Cost-effective 4-line to 16-line Decoder

Decoders are commonly used ICs in digital circuits. Most popular decoders in the TTL family are 7441, 7442 and 74154. IC 7441 and IC 7442 are 4-line to 10-line decoders. IC 74154 is a 4-line to 16-line decoder/multiplexer.

Whenever the design needs 4-line to 16-line decoding, the experimenter is forced to use IC 74154 as there is no other IC available in the market. The cost of IC 74154 is Rs 60 to 70, which is rather high compared to the cost of normally used



TRUTH TABLE

INPUT				OUTPUT OF IC1										OUTPUT OF IC2					
D	C	B	A	1	2	3	4	5	6	7	9	10	11	3	4	5	6	7	9
L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	H	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H
L	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H
L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H
H	L	L	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H
H	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H
H	L	H	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H
H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H
H	H	L	L	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H
H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H
H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H
H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L

ICs. Hence it is well justified to use a low-cost circuit for 4-line to 16-line decoding in the place of IC 74154.

The circuit described here uses three TTL ICs. Though a bit more of wiring effort is involved, the saving in terms of cost is considerable. The circuit should cost about Rs 25 only. (Rs 20 for two numbers of IC 7442 and Rs 5 for IC 7400).

Circuit shows the wiring of two IC 7442s to obtain 4-line to 16-line decoding function. IC1 decodes the 4-bit input in the conventional manner from 0 to 9. For inputs beyond 9, all the outputs of IC1 remain high. All the outputs of IC2 remain high for inputs from 0 to 9. Inputs beyond 9 are decoded by IC2 giving outputs (LOW) from 10 to 15 on pins 3 to 7 and 9. The drive logic for IC2 is provided by IC3. The truth table for the circuit is also shown.

T.K. LOKABHIRAM

Digital Combination Lock

There are several types of combination locks available but most of them are mechanical. Here is a digital electronic combination lock which is much more reliable than the readily available mechanical combination locks. One can open a mechanical combination lock by trying again and again. But this electronic combination lock gives only one chance to open it as it includes an alarm and an auto-cut-off system.

One has to close four switches in a definite sequence to open the lock. (In the circuit shown here, the switch closing sequence has been pre-set as S1, S2, S3 and S4 respectively.) In case a wrong switch is closed, i.e., if this sequence is not

TRUTH TABLE

INPUT				OUTPUT
A	B	C	D	
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
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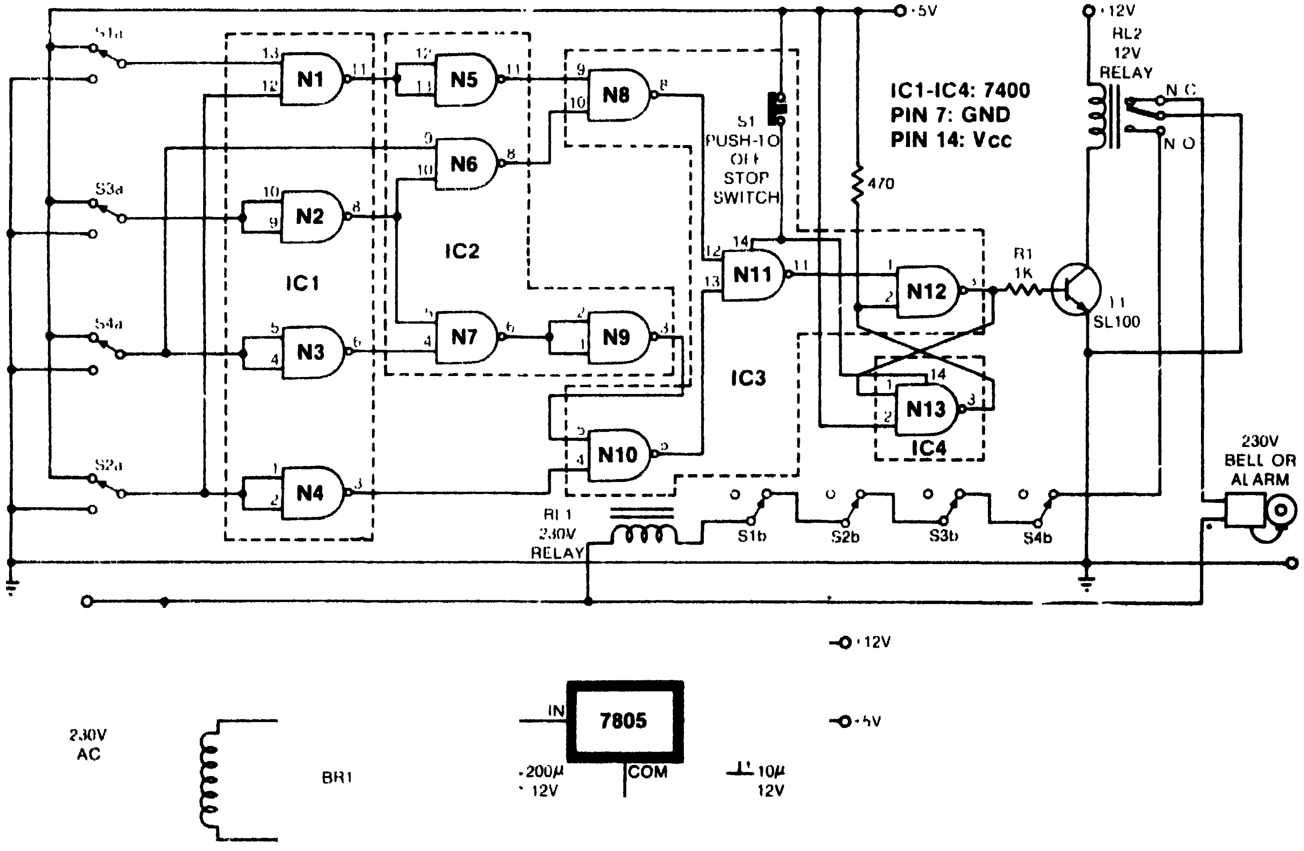
1	1	1	1	1



X1 230V TO 12V (500 mA) SECONDARY TRANSFORMER

BR1 ANY 500 mA BRIDGE RECTIFIER

followed strictly, the alarm will start ringing and alert everyone nearby. The alarm will continue until the stop switch S1 is pressed. And the lock will not open even if the right sequence is followed immediately thereafter. This will definitely scare away any thief.

The circuit is built with four SN7400 NAND gate ICs. These TTL ICs are cheap and easily available in the market.

The truth table is also shown. By using K-map, we get the logic function

$$F = A.B(C+\overline{D}) + \overline{B}.\overline{C}.\overline{D}$$

Here it is evident that there are five combinations of inputs for which output becomes '1'. That means for these combinations, the alarm will not ring.

The four SN7400 ICs may be soldered on a veroboard and connected as shown in the circuit diagram. Four input cords with jack pin on one side are needed. The jack pins should be of different colours. Switches S1a, S2a, S3a, S4a and S1b, S2b, S3b, S4b are ganged respectively. Switches S1b, S2b, S3b, S4b are in series with relay RL1 which opens the lock. Different identification numbers (or letters) may be put on all the switches.

The output is available at pin 3 of IC3. The SL100 transistor activates the relay as soon as it gets an input at its base. The flip-flop built by NAND gates N12 and N13, once activated, remains in the same state. Hence T1 and RL2 also remain active until switch S1 is pressed. The alarm will continue to ring and relay RL1 remains disconnected from the mains.

The power supply circuit is also shown in circuit diagram. A 230V/12V, 500mA power supply transformer and IC 7805 voltage regulator have been used to get a steady 5V DC supply. When activated, the alarm gets connected to 230V mains. Total cost of the unit is around Rs 85.

NILANJAN BHOWMIK

Automatic Brightness Control for Seven-Segment Digital Displays

Here is a circuit which exercises automatic brightness control on LED displays of digital clocks, and for that matter on any seven-segment display unit depending on the ambient lighting conditions.

The basic principle underlying this circuit is the 'on-off control' method of regulating the voltage and hence the brightness. The relationship portraying this is given by:

$$V_{OUT} = V_{IN}\frac{T_{on}}{T_{on}+T_{off}} = VD$$

where V_{OUT} average/DC output voltage

V_{IN} input voltage

D duty-cycle

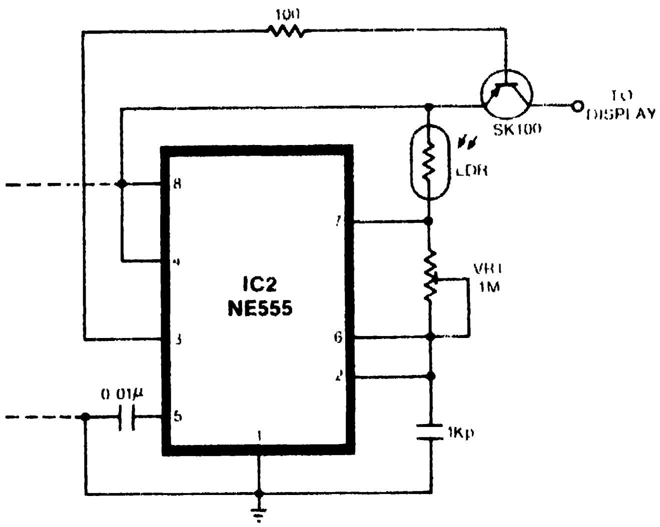


Fig. 2:

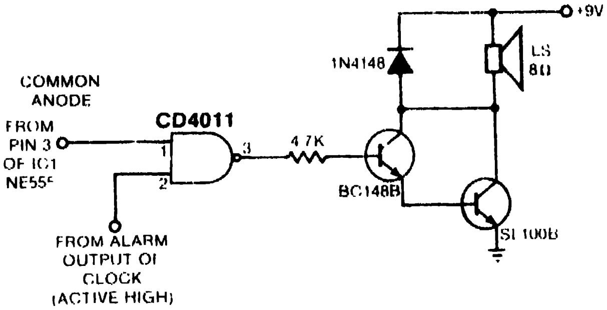


Fig. 3:

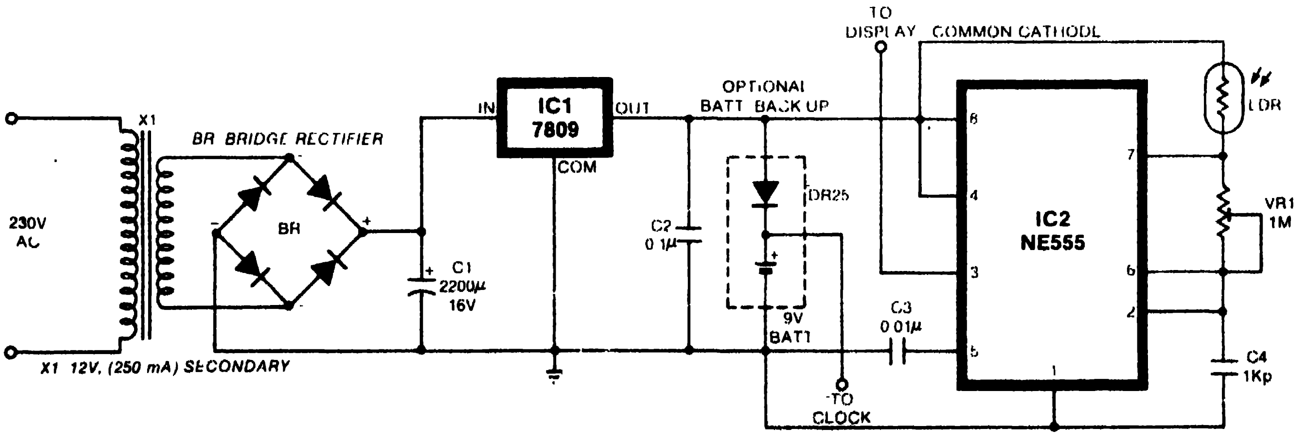


Fig. 1:

T_{on} time when $V_{out} = V_{in}$

T_{off} time when $V_{out} = 0$.

As seen from the equation above, one can control the average DC voltage and hence brightness by varying the duty cycle.

To implement this idea, IC 555 as chopper and an LDR to sense the ambient light are used.

The circuit in Fig. 1 is for common cathode displays and that in Fig. 2 for common anode displays. VR1 is trimmed for optimum display brightness under normal ambient lighting conditions.

Besides brightness control, this circuit provides regulated output voltage over a wide range of input voltages.

The main advantage of this unit over the conventional one is the reduction in mean display current and power dissipation in the series-pass elements of regulating units as the voltage is bucked from a fairly high voltage to the required display voltage.

The circuits shown above are capable of delivering currents upto 200 mA. However, this capability may be increased using higher current handling transistors in place of the existing ones.

Fig. 3 is an extension of the circuit. It is a current driver coupled to a speaker to produce an audible clarion note when the alarm set time is executed.

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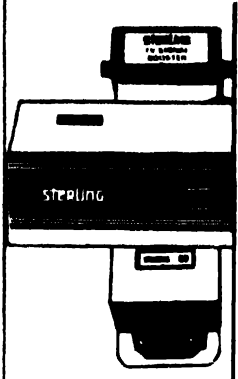

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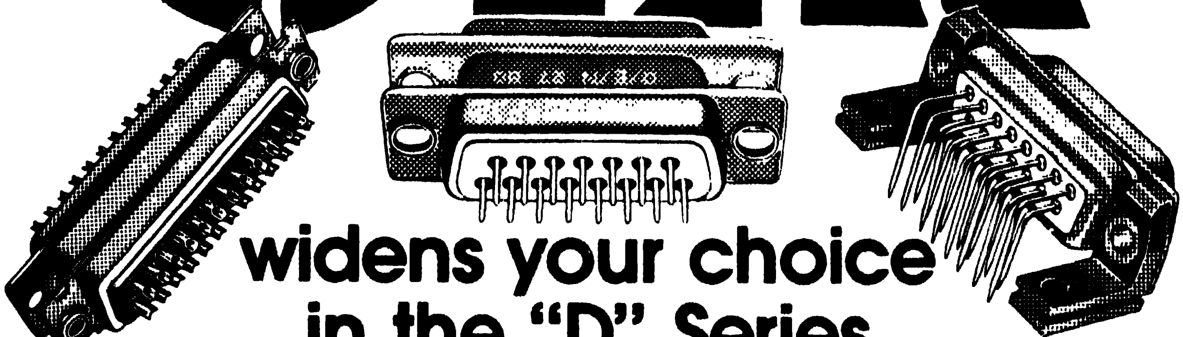

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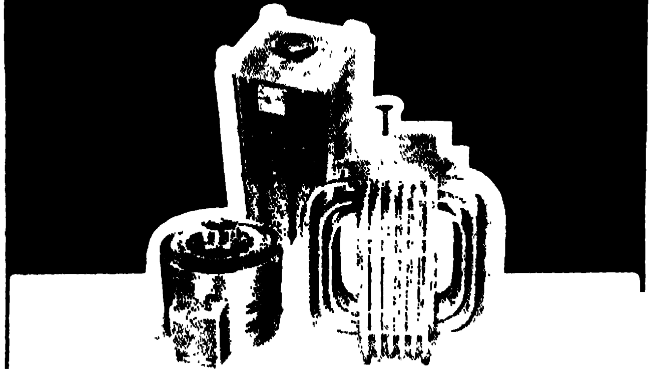

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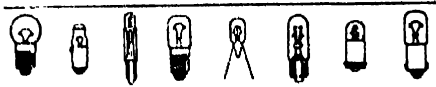

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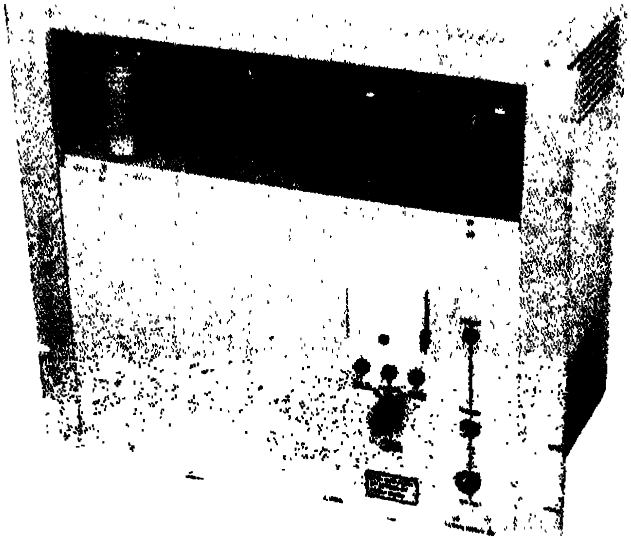

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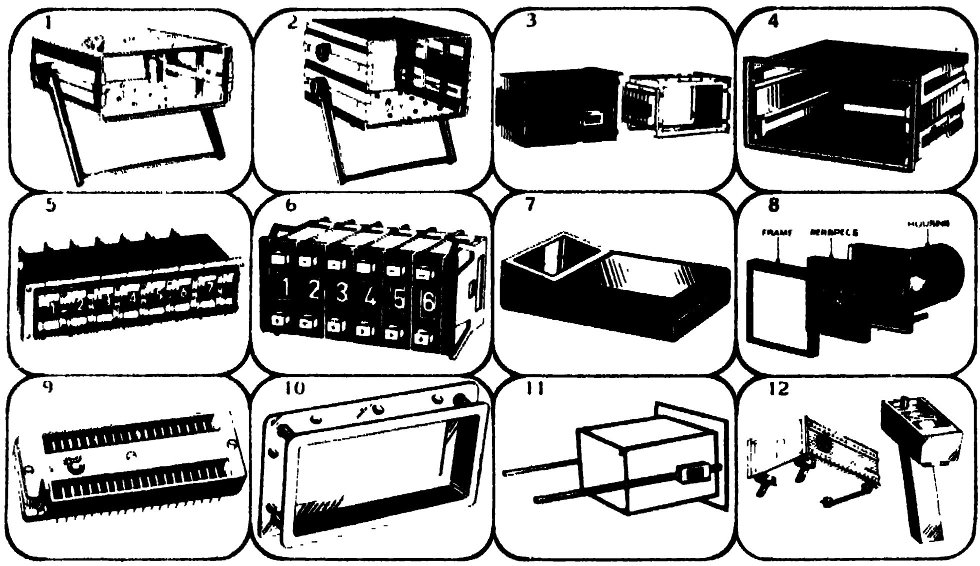

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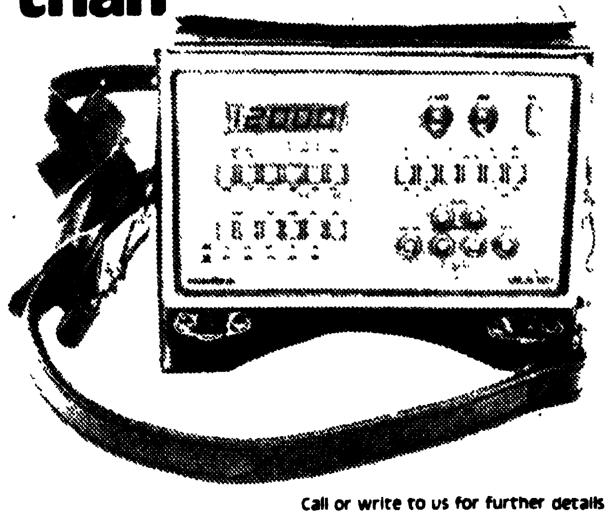

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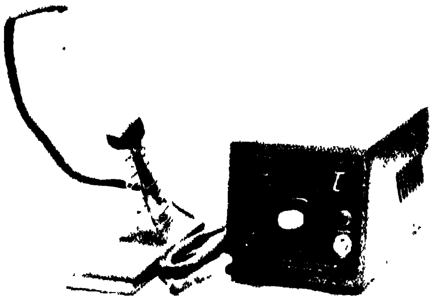

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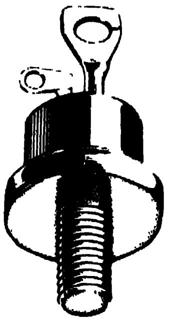

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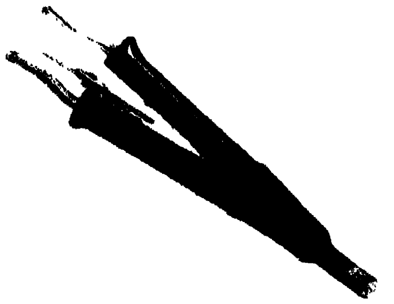

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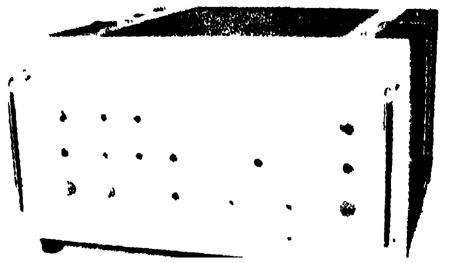

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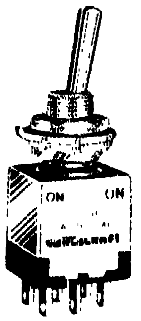

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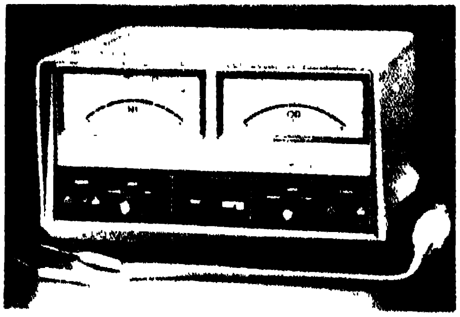

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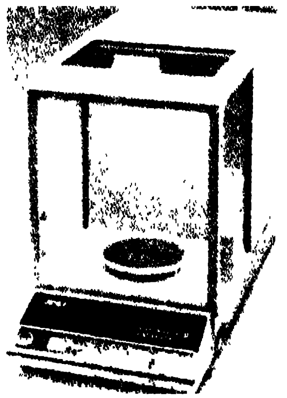

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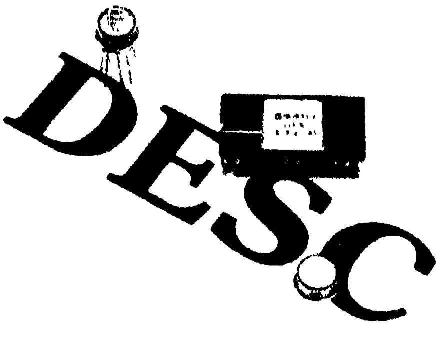

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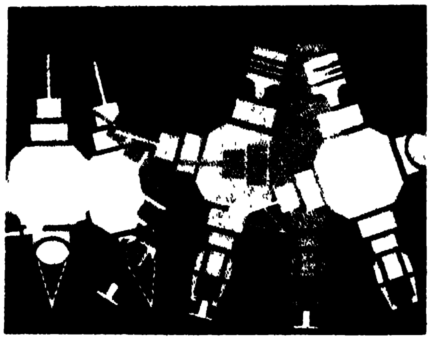

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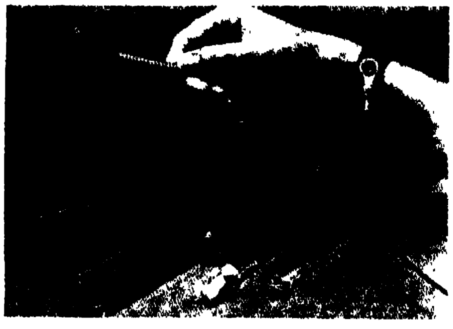
Vermason Limited, England offers a wide range of conductive materials and products for the protection of electrostatic sensitive devices from unwanted static charges in assembly, test and inspection, storage and transport and repair or replacement on site.

To minimise the risk of static damage to devices used in electronics industry, special handling areas (SHA) are essential. All articles and surfaces in the SHA must be conduc-

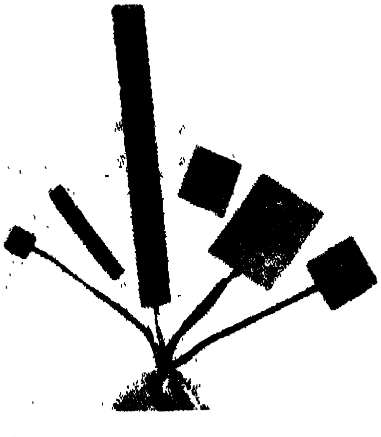


STATIC CONTROL PRODUCTS

tive to ensure that all items remain at equal potential. All Vermason anti static products are electro-conductive, are not dependent on humidity or other climatic factors for their effectiveness and are permanently conductive for the life time of the material.
Contact: Electronic Control Components & Devices, 5, Mangoe Lane, Calcutta 700001

THERMAL-RIBBON TEMPERATURE SENSOR

Thermal Ribbon Temperature Sensor consists of a wirewound resistance element or thermocouple junction laminated into a flat configuration between thin layers of flexible insulation. The response time is much less than the conventional RTDs and the sensor is ideal for mounting on to surfaces for temperature measurement. It gives fast accurate sensing of air, gas, liquid or surface from -328°F to +500°F.

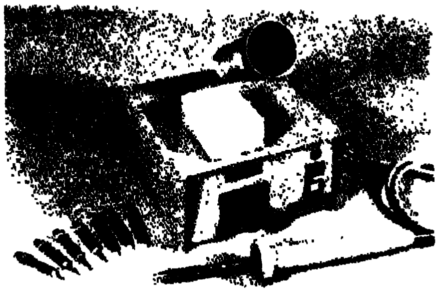


THERMAL-RIBBON TEMPERATURE SENSOR

It finds application in ovens, motors, computer memory planes, process pipeline, medical instruments, refrigeration, electrical components and equipment. They can be supplied with platinum, nickel, copper, nickel-iron, RTDs or as E, J, K and T thermocouples.
Contact: Goodwill Cryogenics Enterprises, 213 Nirman Vyapar Kendra, Sector 17, Vashi, New Bombay 400703.

SOLDERING STATIONS

Litesold's temperature controlled soldering system uses a special 5-transistor and op-amp circuit. The power unit provides a controlled low voltage DC supply to the plug-in light-weight soldering iron, in response to a thermocouple sensor located inside the bit. Spiking, RFI, hum and magnetic effects are totally avoided. The metal power unit case and soldering iron shaft are earthed for screening and static elimination.



SOLDERING STATIONS

Temperature selection, between 180°C and 400°C is done by potentiometer or by tamper proof selector plugs. Soldering irons are interchangeable without recalibration.
Contact: HyTech Services, E 96 Greater Kailash-II, New Delhi 110048

HELIUM-NEON LASERS

Melles Griot, Holland offers zero leak hard sealed lasers with patented symmetrical cathode design that gives exceptional pointing stability. Operating at 632.8 nanometers (red) wavelength, they are provided with brewster window options and give 0.5 mW to 7 mW polarised/unpolarised output power.

Depending upon application, a choice can be made between bare plasma tubes and packaged laser heads, with packaged power supplies or modules and self-contained models.
Contact: Jainsons Engineering and Electronics Corporation, P.O. Box 5245 Bombay 400003

HELIUM-NEON LASERS

LEADLESS CHIP TANTALUM CAPACITORS

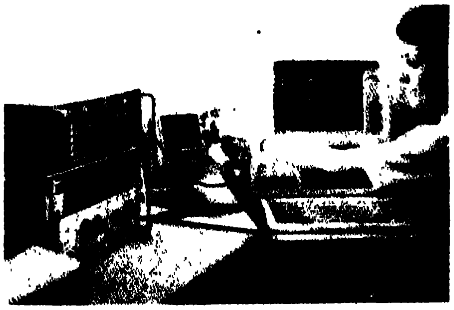
[illegible] Components Group, UK launched their new range of Leadless Chip Solid Tantalum capacitors series TAQ. TAQ has been [illegible] for use in thick film circuits and for direct mounting on to PBCs. They are fully encapsulated and very resistant to damage and moisture. The terminals are tin/lead plated and suitable for attachment by dip or reflow soldering. Their small size allows best use of circuit board area and their format makes them ideal for automatic assembly.

TAQ is available in the voltage range 6.3V to 35V and capacitance 0.1μF to 100μF.
Contact: Jost's Engineering Company Limited, 60, Sir P M Road, Fort, Bombay 400001

LEADLESS CHIP TANTALUM CAPACITORS

AUTOMATED OSCILLOSCOPE CALIBRATION SYSTEM

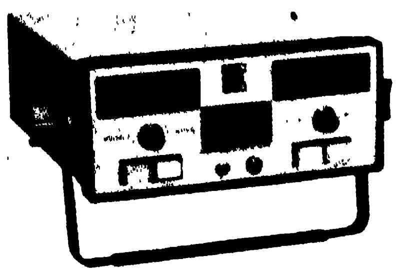
PPM Compucal Series 2000 Automated Oscilloscope Calibration System calibrates all measurement parameters of all types of oscilloscopes up to 1.0 GHz bandwidth, both real time and sampling versions. The system is provided with all necessary hardwares and softwares, depending on required measurement specifications of the users.
Contact: Neotronics International, Post Box 7754, Bombay 400080



AUTOMATED OSCILLOSCOPE CALIBRATION SYSTEM

BROOKTRON ELECTROPLATER

Brooktronics Engineering Corporation, USA is manufacturing Brooktron Electroplater. In this electrochemical process, the actual metal deposition (the thickness of which can be precisely controlled with tolerances of ±0.000050) is accomplished by using a 'brush on' action with hand-held stylus (anode) wrapped with an absorbant material, saturated with the plating solution. The cathode is the part which is plated. The system includes



BROOKTRON ELECTROPLATER

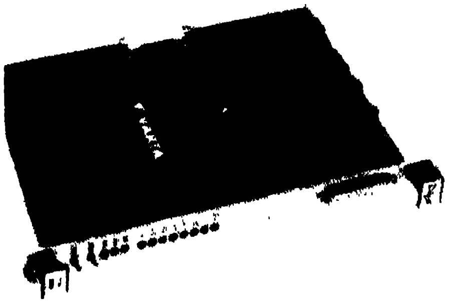
a suitable Brooktron plater as the power supply Brooktron plating tools and specially formulated plating solutions

This has wide applications in the electronic field for printed circuit boards repairs, besides several other important areas of applications

Contact Professional Electronic and Telecommunication Services Assisi Nagar, Bombay 400043

CENTRAL PROCESSING UNIT

Force Computers introduces a new, no wait state', central processing unit at 12.5 MHz The SYS68K CPU-4 series of CPUs incorporate the powerful 68010 virtual processor in addition to a direct memory access controller with up to 128 kBytes of on-board, high speed, static random access memory on one double Eurocard



CENTRAL PROCESSING UNIT

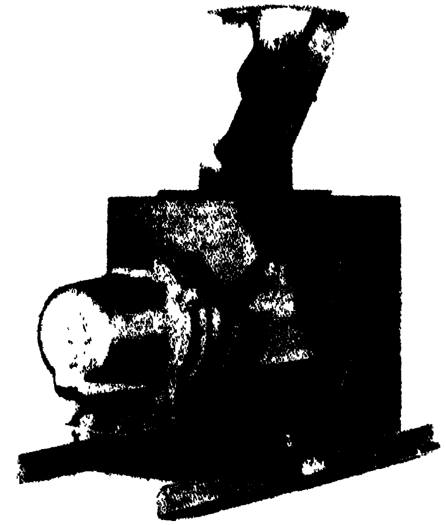
These features, in addition to others, position the SYS68K/CPU-4 products for use by professionals who demand high performance in their applications

Contact SPS Technical Electronic Pvt Ltd, 157 Housing Board Colony, Gulbarga 585103, Karnataka.

IMPACTLINE FLOW METER

Sankyo Dengyo Co Ltd, Japan has developed Impactline Flow Meter for measuring flow rate of bulk solids and powders, e.g., pulverised substances (coal), slurries and fluids in a wide range of 0.5 kg/hr to 10,000 tons/hr and with a high accuracy of 0.5 per cent

Impactline flow meter operates on the unique principle of measuring the horizontal component of impact force, generated when the pulverised material or fluid under measurement falls freely on a sensing plate This force is proportional to the instantaneous flow rate and is not affected by material adhesion on the sensing plate The horizontal component of impact force is converted into an electrical standard signal through transducers and microprocessors.



IMPACTLINE FLOW METER

Contact Toshniwal Industries Pvt Ltd, Industrial Estate, Makhupura, Ajmer 305002

GLO-RING HEAT TOOL

This Glo-Ring Infrared Heat Tool incorporates quartz encapsulated heating elements which open and close like a thumb and forefinger, to encircle the work piece with instant infrared heat, variable in temperature up to 1500° F The interchangeable plug-in elements are gold plated to focus heat towards the centre of the work piece The Glo-Ring is used in the electrical and electronics industry for applications requiring flameless heat, including heat shrinking, plastic tube bending, soldering, adhesive curing, solder preforms, etc

GLO-RING HEAT TOOL

With the new 1.25cm diameter elements, the infrared heat is concentrated in a small area, allowing the unit to be used on very small work pieces. The elements are available for either intermittent use in the Glo-Ring when hand-held, or continuous use when the tool is used with its lock-on button, on the bench stand provided.

Contact The Eraser Company, Inc., P.O. Box 4961/Oliva Drive, Syracuse, New York 13221.

FREE KEYBOARD DESIGNER'S KIT

Industrial Electronics Engineers Inc. (IEE), a leading manufacturer of electronic products is providing Free Designer's Kits to engineers involved in the planning and specification of custom keyboards and front panel assemblies.

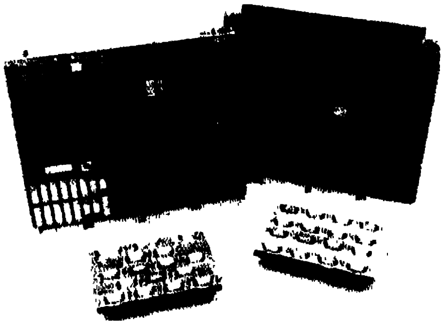
Each kit contains checklists, work sheets and a suggested reading list A custom, plastic pickett drafting template is also included. It can be used to speed up the drawing of standard or custom keycaps in a variety of shapes and sizes, and also simplifies keycap spacing. Additional cutouts on the template can be used for standard radii and screw heads, making it useful for general drafting and sketching tasks as well

FREE KEYBOARD DESIGNER'S KIT

Contact: Industrial Electronic Engineers Inc., 7740 Lemona Avenue, Van Nuys, CA 91405

DIGITAL MULTIPLEXER

MDB Systems Inc announces a Digital Multiplexer Family (DMF) of high speed expandable multiplexer systems for Unibus and VAX computers This provides significant performance benefits over other controllers such as the DZ and DH11, due to its capability to switch between DMA and programmed I/O SILO mode.



DIGITAL MULTIPLEXER

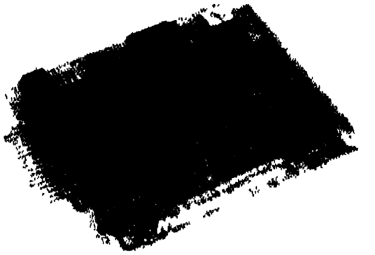
Short messages are sent direct via programmed I/O mode, and there is no DMA set-up time involved Longer messages are sent via DMA, not broken up as in programmed I/O mode The total capability of up to 256 terminals is based on the utilisation of a 29116 ultra-high performance 16-bit microprocessor

Contact. MDB Systems Inc.. Corporate Headquarters, 1995N. Batavia Street, Box 5508, Orange, California 92267-0508

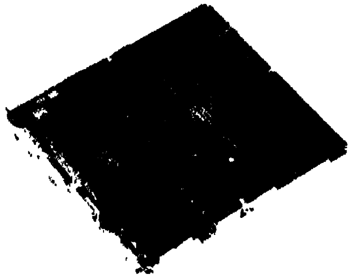
IBM COMPATIBLE ADD-ON CARDS

The CPU-PC Main Board is a single computer board compatible with the IBM PC The main board houses a 16-bit 8088 CPU with a socket for the optional 8087, maths co-processor. It has a standard 128K bytes of random access memory (RAM) and the system can be expanded to 640K bytes It has five IBM PC compatible ports for user interface. In addition there is a fully programmable RS232C interface and a parallel port with Centronics interface

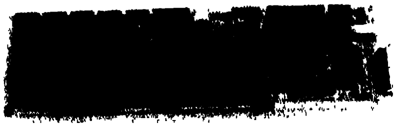
Contact· Multitech Industrial Corporation, 266 Sung Chiang Road, 9F, Taipei, Taiwan Republic of China



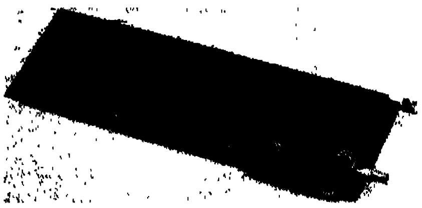
DISC DRIVE ADAPTER—FDI—PC



CPU-PC MAIN BOARD



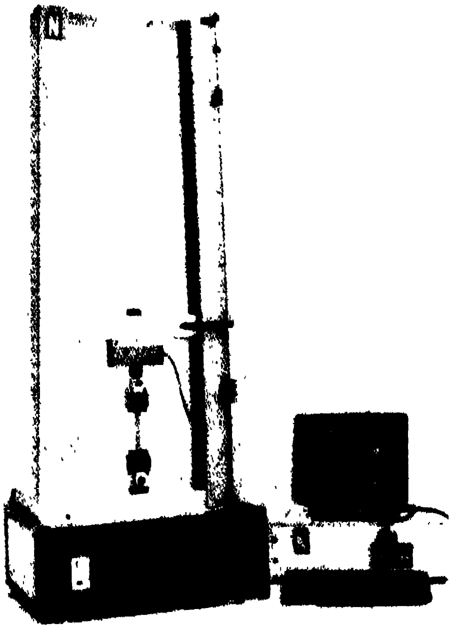
MFB—PC MULTIFUNCTION BOARD



3278—PC INTERFACE CARD

COMPUTER-CONTROLLED UNIVERSAL INDUSTRIAL TESTER

All the benefits of microcomputer control and data processing are combined with mechanical components of proven ruggedness and reliability in a universal testing machine from Britain Incorporating a closed-loop tacho-feedback servocontroller and recirculating ballscrews, the MC3000 offers a maximum force capacity of 30 kN in either tension or compression modes, and speed is infinitely variable from 0 5 to 500 mm/min.



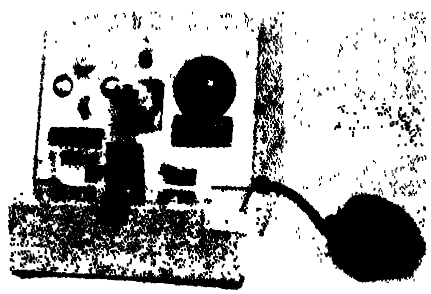
UNIVERSAL INDUSTRIAL TESTER

All functions are controlled from the computer which also provides full facilities for processing test data. Software is available for tensile, compression and flexure testing. Direct force and displacement data and stress and strain data can be indicated in absolute units. A graphics capability permits test data to be displayed in the form of a graph. Outputs are provided for transferring data to plotters and printers.

Contact: Nene Instruments Ltd, 21/23 Park Road, Wellingborough, England NN8 4PW

BLUE ARC STRIPPER

The MSS-205 Blue Arc Coaxial Braid Stripper cleanly severs the braid of shielded wires at a predetermined point, and fuses the individual strands of the braid together to prevent fraying.



BLUE ARC STRIPPER

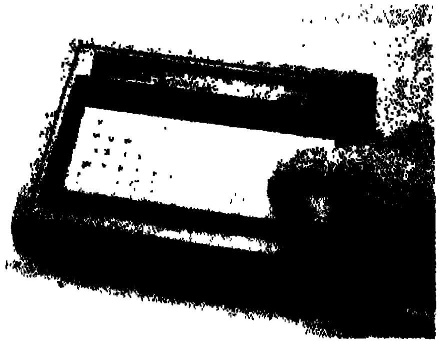
To strip a braid, the wire end with the braid exposed is placed in the bottom electrode, and the 5-position power selector switch is set to the level desired to control the degree of severing When the footswitch is pressed, the electropneumatic controls automatically complete the stripping by use of high current, low voltage AC electricity The MSS-205 measures 25 cm × 40 25 cm × 25 cm and weighs 75 lbs , operates from a 220/240V, 50/60Hz power supply, and requires a 90 PSI air supply.

Contact Rush Wire Strippers, P O. Box 4961, Townline Road, Syracuse, New York 13221.

MINI-TERMINAL

A touch-sensitive keyboard and an LCD window are the external trademarks of a mini-terminal presented by Siemens for the microcomputer systems It is virtually as powerful as a conventional terminal with VDU and desk-top keyboard CMOS devices are the mini-terminal's internal trademark 80C31 microcomputer, EPROM (up to 8 kB) and RAM (up to 16 kB) The unit allows program sections to be transferred from the development lab to the place of application or amended there. The mini-terminal can be battery-operated for up to 8 hours A second battery backs up the CMOS RAM

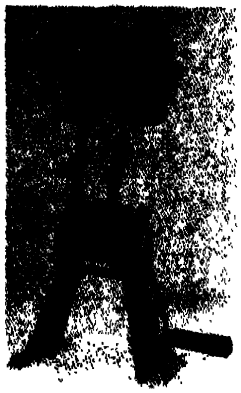
Contact: Siemens AG, Zentralstelle für Information, Postfach 103 D-8000 Munchen 1 Federal Republic of Germany



MINI TERMINAL

COMPONENT LEAD FORMER

The Model Arm-1 component head Former is a compact, bench-mounted, hand-operated unit designed to cut and bend at 90°, axial components up to 2 watts. The unit is robustly



COMPONENT LEAD FORMER

constructed to handle larger component leads with ease. The sequential method of cutting and forming prevents axial torsion and mechanical stress on the component body and leads. The adjustable forming dies permit underbending on components to produce a lock in configuration, if desired.
Contact Wybar Electronics, P.O. Box [illegible] Vincent Drive, Syracuse, New York [illegible]

PRECISION TEMPERATURE FORCING SYSTEM

To meet the demanding requirements of computer controlled test facilities, Thermonics introduces the Precision Temperature Forcing System. This versatile test system provides the test engineer with the capability of testing components such as integrated circuits, hybrids and discrete devices at the

PRECISION TEMPERATURE FORCING SYSTEM

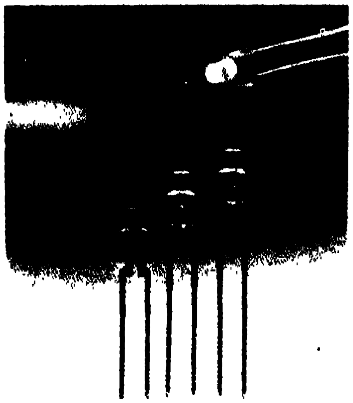
temperature extremes of -70° C to +200° C directly on the autotester performance board.

This is a single stage mechanical refrigeration system (no LN2 or CO2 required) with microprocessor-based control system and thermal fixture, and is housed in a roll around chassis. This system heats/cools devices by forcing a stream of temperature controlled air over the device to be tested.
Contact Hindco Corporation, Shiv [illegible] Numh, 205-A Dr Annie Besant Road, Worli Naka, Bombay 400018.

FIBREOPTIC RECEIVER

Hewlett-Packard Company's Fibreoptic Receiver operates at speeds up to 150 MHz with low noise and high responsivity. This serves as a low-priced alternative to metallic link for many applications in communications equipment, computers and other markets. Low noise and high responsivity improve its performance. The current which passes through the photodiode when no light is shining on it mesures a low 300 pA at 20 volts reverse bias. This lowers the noise level of the entire receiver.

The low capacitance, 1.5 pF, improves the [illegible] performance of the user's preamplifier.



FIBRE OPTIC RECEIVER

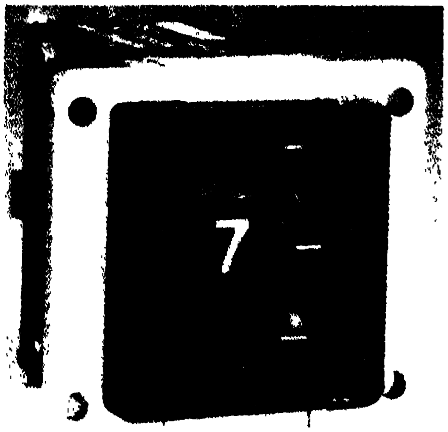
Hewlett Packard has also integrated several microwave components previously used in counter manufacture onto a single hybrid GaAs circuit. This has yielded two microwave frequency counters the HP 5350A and 5351A. The counters measure 20 GHz and 26.5 GHz respectively, with resolution better than 1 Hz. The counters sensitivity is rated at 25 dBm at 500 MHz to 12.4 GHz, 20 dBm at 12.4 to 20 GHz and 15 dBm at 20 to 26.5 GHz. The high sensitivity permits the counters to be used in applications where very low signal levels are present.

The Company's new microwave scalar network analyser, the HP 8757A incorporates operating and performance features to increase user productivity in traditional measurements of microwave components as well as in other applications.

The HP 8757A analyser, combined with a swept-frequency signal source, microwave bridge and detectors, measures transmission and return loss from 10 MHz to 26.5 GHz in coax and to 40 GHz in waveguide (with provisions for still higher frequencies).
Contact Blue Star Limited, Band Box House, Prabhadevi, Bombay 400025

THUMBWHEEL SWITCH

This 7000 series Thumbwheel Switch offers, in addition to its shielding properties, a completely sealed contact area that is impervious to salt spray, dust and high humidity. The corrosion-resistant unit can be used safely in combustible or explosive environments and in ambient temperature ranges from -65° to +85° centigrade. Illumination lamps are replaceable without tools or soldering and provide illumination without glare in low ambient light. The 7000 series is available with PCB or cable termination.



THUMBWHEEL SWITCH

Altitude rated to 21,335 metres the light-weight switch (approximately 0.40 ounce) is ideal for aircraft or shipboard applications, or wherever rugged military-grade quality is called for.
Contact EECO Limited, Trafalgar Way, Bar Hill, Cambridge CB38SQ England

CONNECTORS

Alpha Wire Corporation, USA manufactures twist on BNC and TNC coaxial cable connectors. These connectors have one piece construction and provide an easy, dependable means of terminating coaxial cables. There are no loose parts in the connectors. Rated at 40 lbs they have a good tensile strength when properly installed. No soldering or heating which could damage the connection, self centering design allowing the centre conductor to easily enter the contact mechanism, centre contact eliminating vibration or corrosion interference, damage or loss are some of the special features.
Contact Krishna Agencies & Services Company, P.O. Box No. 4106, Jayanagar, Bangalore 560041

CRT MEASUREMENT PHOTOMETERS

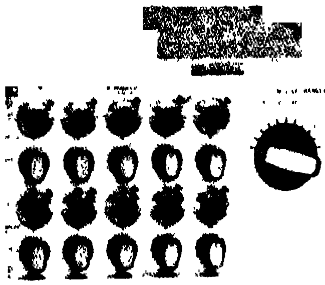
United Detector Technology has launched two more CRT Measurement Photometers. The first model is designed for laboratory applications. The standard system employs a photometric detector/filter head in conjunction with special optics to achieve a 15° field-of-view. In addition, an optional reflex viewing module accommodates a variety of lenses that allow the instrument to measure areas down to a single pixel, or up to partial or full screen. To insure accurate and meaningful luminance measurements, spectral response is matched to the human eye, and electronic bandwidth is designed to correctly average the raster scan of CRTs.

The second model is designed for manufacturing and inspection use. It is a self-contained hand-held instrument that measures full-screen brightness. Featuring low cost and a compact, rugged design, it is expected to find wide use by quality assurance personnel on CRT production lines.
Contact. Toshni-Tek International, 267 Kilpauk Garden Road, Madras 600010.

MEASURING POINT SELECTOR UNIT

The Manual Measuring Point Selector Unit UMG10 from Hottinger Baldwin Messtechnik GmbH, West Germany permits the simultaneous connection of ten measuring points to any measuring amplifier Individual zero balancing can be carried out for each measuring point

The UMG10 is very easy to operate, and any strain guage bridge configuration and inductive transducer can be connected As the unit does no require a power supply, it lends itself to mobile use

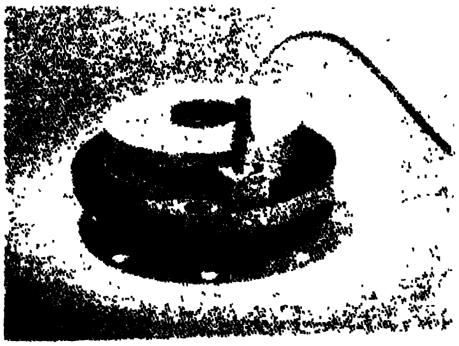


MANUAL MEASURING POINT SELECTOR UHG 10

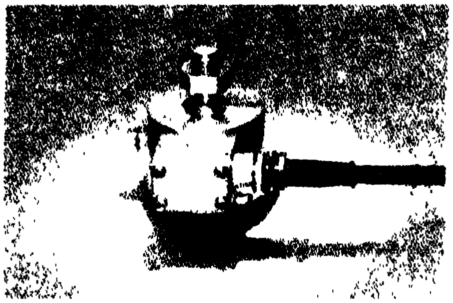
Problem pressure measurements in viscous and highly viscous media are eliminated by the Absolute Pressure Transducers The transducers, which are suitable for measurements in gases and liquids consist of corrosion-resistant steel and can be over loaded to ten times their nominal pressure without damage The measuring elements are equipped with metallic strain gauges using the latest thin film technology and possess good zero signal stability Temperature effects between 40 C and +100 C are compensated

ABSOLUTE PRESSURE TRANSDUCER

The Force Transducer Z12, a new design is distinguishable from conventional mounting flange and its inner bore allows easy installation in testing machines where loading can be both compressive and tensile. It has the extremely good accuracy class of 0 03



FORCE TRANSDUCER Z12

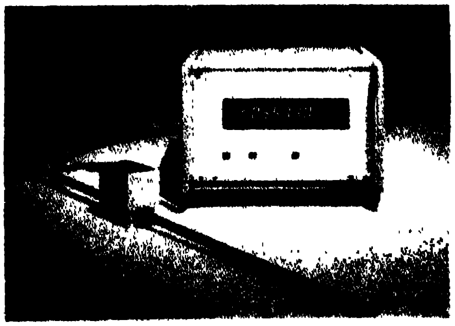


FORCE TRANSDUCER U2A

New Compressive Force Transducers type C9 and C90 made of corrosion resistant steel and are small and sturdy They are available for nominal values of 10 kN and 20 kN Because of their small dimensions, these transducers can easily be incorporated into existing equipment These new force transducers use the latest strain gauge technology and are to accuracy class 1

FORCE TRANSDUCER C9 & C90

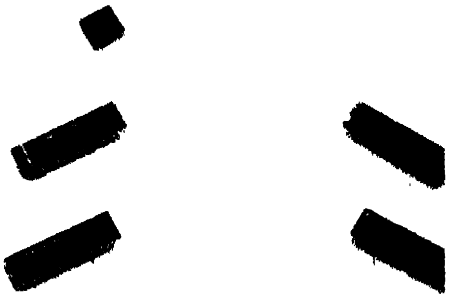
The new Inductive Displacement Measuring System developed by the company detec [illegible] splacements of upto 1 9 m with a resol [illegible] of 10µm Speeds of upto 15 m s [illegible] ll with permitting measurement even [illegible] lly moving objects The displacement [illegible] cted by means of a transducer The syst [illegible] recognises the directions of movement and can add or subtract displace [illegible] rom the display with the correct sign This new system has the added advantage of being unaffected by dust and dirt
Contact Integrated Process Systems, 278 III Floor, Khaleel Shirazi Estates, Pantheon Road, Madras 600008



NEW DISPLACEMENT MEASURING SYSTEM

INTEGRATED A/D CONVERTER

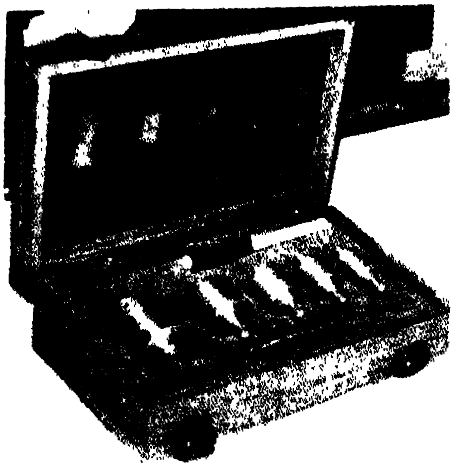
Utilising CMOS technology, this family of Dual slope Integrating A/Ds introduced by Maxim features excellent differential linearity, high NMR of power line frequencies, virtually no zero offset, 5 PPM/°C and maximum gain temperature coefficient All these incorporate a 'zero integrator' phase to ensure fast recovery from over range inputs Maxim has increased ESD protection to greater than 2kV on each pin thus reducing field failure rates
Contact Mainar Corporation, 43, Wheeler Road, Cox Town Bangalore 560004



INTEGRATED A/D CONVERTER

ACCELEROMETERS

Accelerometers manufactured by ACD Machine Control Company are piezoelectric type They are polarised and exhibit definite electrical properties essential for detecting vibrations seismic movement high frequency noise etc Totally stainless steel construction consists of piezoelectric discs mounted on studs and a total casing which acts as a mass Its sensitivity is atleast three times more than any conventional moving mass piezoelectric accelerometers

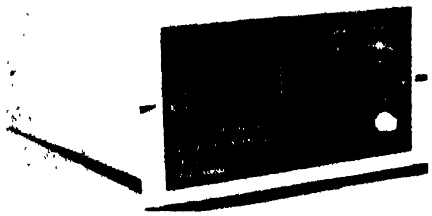


ACCELEROMETERS

The output is directly taken out and terminated on UHF male connector without use of any adhesives Therefore, long term consistency is achieved The cable length is normally one metre This accelerometer is rugged and immune to any electromagnetic forces such as high intesity 50 Hz field
Contact ACD Machine Control Company (P) Ltd, E 6, Udyog Sadan No II, MIDC Andheri (E), Bombay 400093.

TEMPERATURE INDICATOR

Temperature Indicator Digitally Linearised (type DTI-L) is an accurate and dependable instrument for measuring temperature from 0° to 1700°C.



TEMPERATURE INDICATOR

Linearisation is based on data stored in EPROMs. Each point of the thermocouple is stored in the memory. Instrumentation grade amplifier gives excellent linearity, low drift and high input impedance. Automatic line resistance and cold junction compensation are incorporated. Individual LEDs are provided for open thermocouple reverse thermocouple and over-range indication.
Contact: Analog & Digital Instrumentation, 962, GIDC Makarpura, Baroda 390010.

INK CARTRIDGE

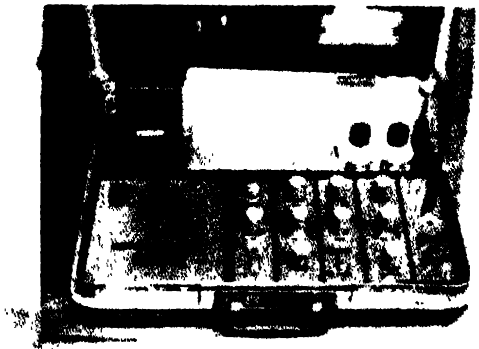
The latest Ink Cartridge developed by Arora Enterprises is suitable for Kents recorder. 'Suvichem' slow drying precision recording ink is filled in these cartridges and ink-filled cartridge are supplied with red, green, blue, black, violet, orange and yellow colour inks.

INK CARTRIDGE

The cartridges are made from best quality, high density polythene.
Contact: Arora Enterprises, 301, Sheth Chamber, Marimata Lane, Rajmahal Road, Vadodara 390001.

DIGITAL PORTABLE KIT

Century's digital water analyser kit called Digital Portable Kit has been designed for the on-the-spot study of parameters such as pH, conductivity, redox potential, temperature and dissolved oxygen. Housed in fibreglass brief-case, this is a true portable kit most suitable for pollution control and environmental studies. The kit has LCD display with both battery and mains operation. Single 9V battery operation, reduced battery consumption, automatic low battery indication are its other features.

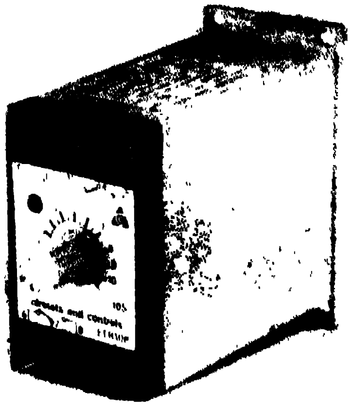


DIGITAL PORTABLE KIT

Contact: Century Instruments Pvt Ltd, S.C.O. 289, Sector 35-D, Chandigarh 160036.

ELECTRONIC TIME RELAY

Electronic Time Relay ETR ID is a solidstate ON delay timer that operates with high repeat accuracy between wide ranges of voltage, frequency and temperature. The timer uses a RC bridge type timing circuit, nullifying the effect of voltage variation and a trigger circuit that switches an electromagnetic relay giving smart and positive operation. Use of glass-epoxy PCB eliminates the chances of leakages or breakdown. The power supply is indicated by a green LED marked 'V' (voltage).



ELECTRONIC TIME RELAY

The timer comes in a moulded plastic casing and the terminals are designed in slots so that the line parts are not easily touchable.

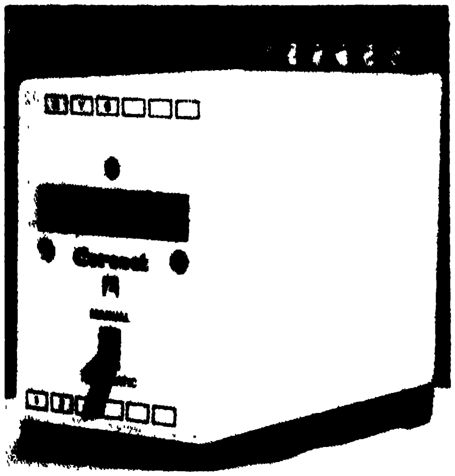
The timer is available for 110/220V AC supply voltages at 50 to 60 Hz. Permissible ambient temperature limit is between -15°C to +55°C and voltage limit is between 80 to 110 per cent of rated voltage. It consumes about 6.5A with contact rating of 5A.
Contact: Circuits and Controls, 12/4, Bhattacharya Para Lane, Calcutta 700036.

AUTOMATIC MOTOR CONTROL RELAY

The Coronet Automatic Motor Control Relay is a must for motors which are run by maintained contact devices such as, floatswitch, pressure switch,' thermostat switch, etc, so as to prevent starting of the motors on 2-phases.

It starts the motor as soon as the power supply resumes. No attendant is required to switch on the starter button. It stops the motor in case of phase failure, phase reversal, low voltage and high voltage. The motor is automatically started when the missing phase supply resumes or the voltage comes within the operating range.

Built-in trip time delay avoids nuisance trippings caused by momentary line voltage fluctuations. Fail-safe design allows it to pick-up only under healthy conditions of power supply and drop off if there is any fault or an open circuit. It protects the motor under all conditions of load, even under no-load conditions. Its indicating lamp glows only when the power supply is normal and phase sequence is alright. The HP rating of the motor is immaterial since this device is not current dependent. A bypass switch (toggle switch) is provided in the device which enables the user to run the motor manually from the motor starter as usual.



AUTOMATIC MOTOR CONTROL RELAY

Contact: Coronet Control Devices, Deonghat, Golan 173211 H.P.

CARGARD-DELUXE

Bhatts Electronics has introduced a Cargard Deluxe alarm system which is easy to instal. It neither interferes with the existing car wiring nor requires any extra wiring to activate the alarm. This model has a built-in adjustable time delay which allows the entry time delay to be varied from 5 to 15 seconds, in order to accommodate a longer or shorter entry time for owners to enter the vehicle and switch off the alarm before the alarm actually starts. The Cargard has a sensor which needs to be clamped to the main electrical lead of the car.
Contact. Elsonic Santo Corporation, 8/1, Palmgrove Road, Bangalore-560047.

CARGARD-DELUXE

DIELECTRIC COATING

ESL's new cermet Dielectric Coating, 4905-C, resists substrate warping even with many layers and refirings. Because the temperature

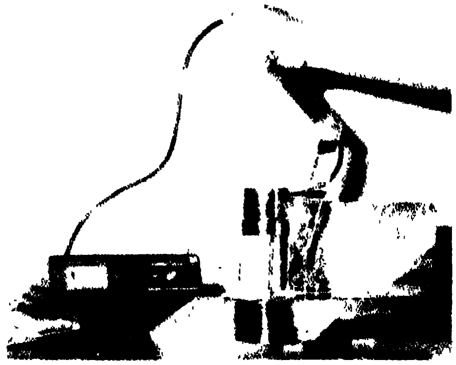
DIELECTRIC COATING

coefficient of expansion (TCE) this model is carefully matched to the TCE of the alumina substrate. In recent user evaluations 4905-C was successfully used to produce a conductor layer multilayer (24 separate dielectric prints) with no harmful bowing of the 10 cm × 15 cm alumina substrate. The high density of this non-porous multilayer dielectric permits the use of economical palladium-silver 'buried layers with a gold top layer without blistering or shorting.

Contact: Eltecks Corporation, C-314 Industrial Estate, Peenya, Bangalore 560058

DIGITAL WATER CURRENT METER

This Water Current Meter can be used for measurements in fresh water as well as saline sea water directly. The underwater current sensing probe has got streamlined design features and aligns with water flow keeping the rotor always in vertical axis despite the tilting of the suspension rope. The electric pulses produced proportional to the rotation of the rotor are processed and displayed in the digital meter directly in the range of 0 to 400 cms/sec. The compact meter is operated on self-contained 9V dry cells with current consumption less than 50 mA. The meter with hydro-dynamic design features needs comparatively very low fish weight enabling easy and convenient operation.



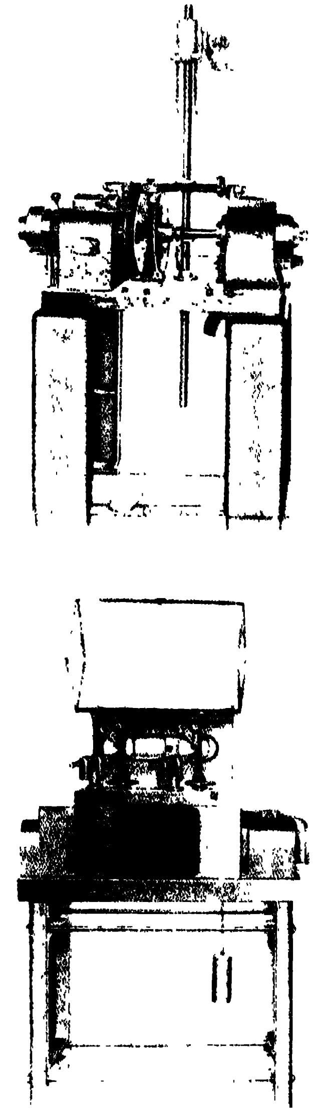
DIGITAL WATER CURRENT METER

Contact: Environmental System Engineers, Kadavanthra Road, Cochin 20.

TV DEFLECTION COIL WINDING MACHINES

These are equipped either with double spindle mechanical and electrical controls or electrical, pnuematic and mechanical controls. The main motor runs on 440V AC, but the entire circuit runs on 24V DC. These are available in two models, one suitable for horizontal coils and other for vertical coils of TV deflection yokes.

Model GS TVP is equipped with electrical, pnuematic and mechanical controls.



TV DEFLECTION COIL WINDING MACHINES

Mechanical clutch, solinoid airvalves, magnets and electrical timer are used in this machine to make the operation more efficient with maximum automation. This machine is suitable for horizontal coils of TV deflection yoke.

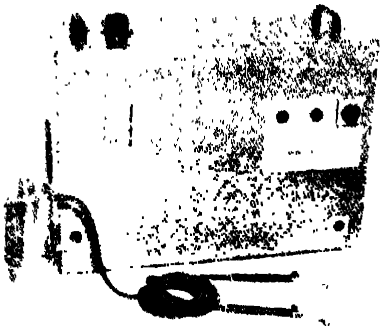
Model GS-TVL is equipped with double spindle, mechanical and electrical controls and clubbed by electromagnetic clutch, solenoid magnets etc. The machine is suitable for vertical coils of TV deflection yoke.

Contact: Gahir Industries (Regd), 2816 Street-1, Jammu Colony, Opp. Atam Park, Ludhiana 141003.

MICRO BRAZER

Micro Brazer is a unique machine for multipurpose brazing/soldering of small parts with pin-point application. It generates its own fuel, i.e., a mixture of hydrogen and oxygen gases, consuming inexpensive distilled water by the electrolysis process. It has its unique built-in safety devices to keep the pressure of this mixture at a controlled low pressure.

The self-generated hydrogen-oxygen mixture is passed through a gas atomiser containing appropriate solution (i.e. methylated spirit, MEK, acetone, depending on the flame temperature required) and discharged through a micro torch with fine flame regulation, to give a very fine controlled and cleaner high temperature flame.



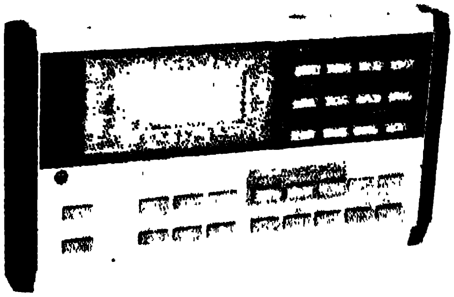
MICRO BRAZER

Contact: Harshida Engineering & Electric Co., 49, Laxmi Insurance Building, Sir P M. Road, Bombay 400001.

LOGIC ANALYSER

The Logic Analyser HIL 2010 gives a new dimension to the use of logic analysis in field troubleshooting. Weighing merely a kilogram and with unprecedented system packaging (253W × 140D × 38H mm).

It has 16 channels, operating both in synchronous and asynchronous modes. The state analysis offers powerful features like search, compare (with a separate reference memory having same depth as the acquisition memory) and a choice of display formats. The timing analysis also is equally powerful with glitch capturing facility, expand mode etc. This hand-held logic analyser also offers a flexible triggering system with pre, post, centre trigger, with trigger and clock delays. A window display presents a comprehensive map of the acquisition memory highlighting, among others, the trigger point and the displayed data location. A histogram display is another special feature. It displays a ratio of high bits to low bits in each channel.

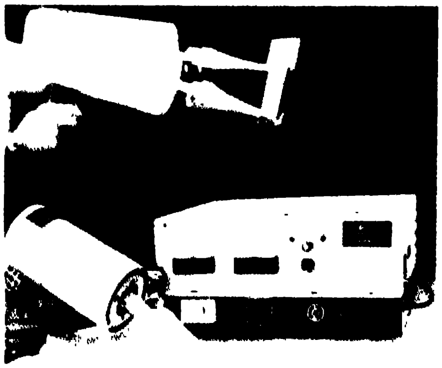


LOGIC ANALYSER

Contact: Hindustan Instruments Limited, 603 Vishal Bhawan, 95 Nehru Place, New Delhi 110019.

ULTRASONIC PLASTIC WELDER

It is a compact, lightweight ultrasonic hand-



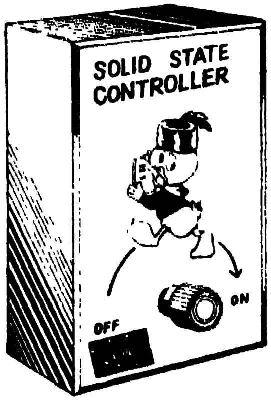
ULTRASONIC PLASTIC WELDER

held plastic welder designed specifically for rapid spot welding of thermoplastics It consists of a generator, welding head fitted with transducer, pistol grip handle and welding tool It can spot-weld thousands of spots at the rate of one weld per two to four seconds Clean and fast welding is possible by localised ultrasonic vibratory heating and molecular flow No messy chemicals are required and cost of chemicals is also eliminated It is ideally designed for welding assemblies that cannot be positioned under a welding head, and is also good for hard-to-reach joint areas. Hermetic dust proof and clean seals are possible

Contact. Imeco Ultrasonics, Post Bag No 16643, Matunga, Bombay 400019

SOLIDSTATE CONTROLLER

The Solidstate Controller (Dimmer) is developed with radio frquency suppressor with linear motion It is useful for controlling the power of light, fan, iron, oven, sewing machine, stirrer etc The circuit is mounted in acrylic body of 6·25 cm × 8·75 cm × 3.22 cm. The circuit is also available mounted on PCB without cabinet which can be used in table-lamp or any other accessories

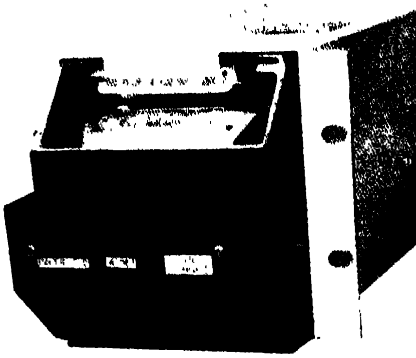


SOLIDSTATE CONTROLLER

Contact Electronics Hobby Centre, F-37 Nand Dham Industrial Estate, Marol, Bombay 400059

NUMERIC PRINTER

This Numeric Printer uses rugged and reliable EPSON print mechanism 460 It is housed in most compact quarter size of 47.5 cm sub-rack which can be mounted into a panel as well as used separately on a table The printer is designed with a draw-put mechanism whereby it is not necessary to disturb the panel mounting whenever the paper roll has to be replenished The front panel features are simple and kept to a minimum, namely, print push button and paper feed pushbutton. The back panel contains standard D sub-connector to accept the various data lines. The printer can accept parallel data as well as multiplexed data A separate input line is provided for colour change When this line becomes active, the printer prints the line in red colour



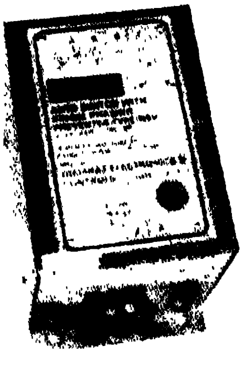
NUMERIC PRINTER

Contact. Arun Electronics Pvt Limited, B/125-126, Ansa Industrial Estate, Saki Vihar Road, Bombay 400072.

AUTOMATIC SINGLE PHASING PREVENTER

The single phasing preventer is a voltage filter where negative sequence voltage is sensed and used to trip the motor starter It uses ICs to protect 3-phase AC motor against single phasing, unbalanced supply, and too high, too low voltage In case of wrong phase sequence the motor automatically gets switched off within three seconds, thus preventing motor from being burnt. After getting normal voltage it automatically switches on the motor. No manual operation is needed. Suitable for all HP motors

Contact M R K & Brothers Engineers, 310 A, Commerce House, Nagindas Master Road, Fort, Bombay 400023



AUTOMATIC SINGLE PHASING PREVENTER

FLEXIBLE CABLES & CORDS

The cable on hand-operated Power Tools and appliances needs to be highly flexible and resistant to abrasion, mechanical stresses and extremes of temperature The Novoflex Flexible Cable is specially designed for this purpose. Special PVC compounds are used for these cables for extra flexibility, resistance to water, oil, acids, alkalies, grease and sunlight and if ignited they arrest the spread of fire These cords have good ageing properties, are light in weight, smooth, glossy, unkinkable easy to handle and to clean. Clear colour coding of the insulation is possible and colours penetrate the entire insulation

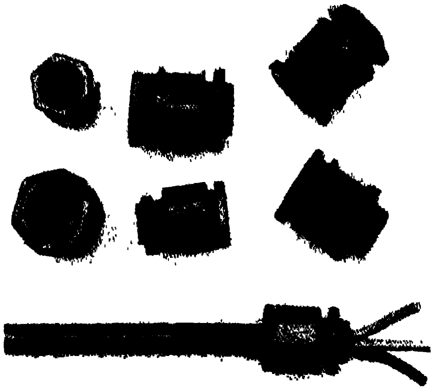
FLEXIBLE CABLES & CORDS

These cords are particularly suitable for application in very wide range of house hold-industrial appliances. These cables are ISI marked.

Contact: Novoflex Cable Industries, Block A-14, 7th Floor, Chatterjee International Centre, 33A, Chowringhee Road, Calcutta 700071.

POWER CORD CONNECTOR

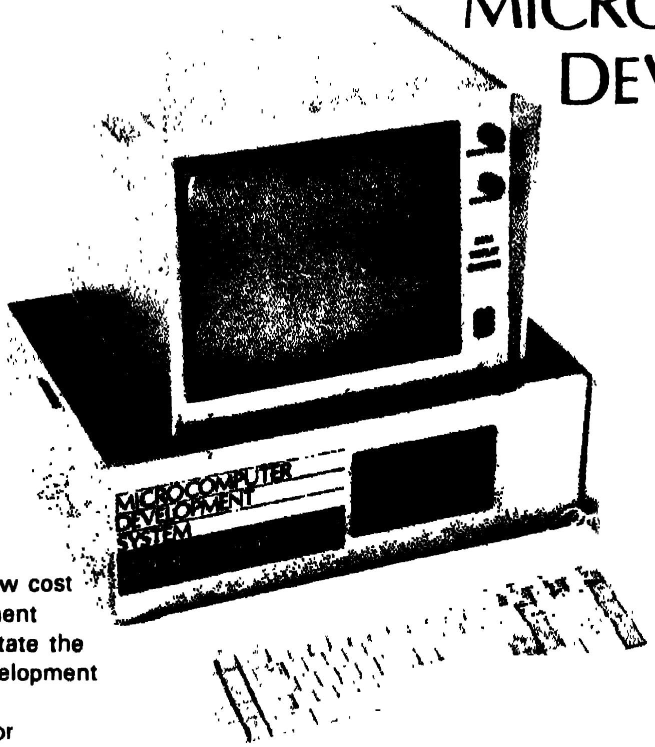
This unique new Power Cord Connector outperforms traditional connectors. In one single operation, by merely inserting the cord or cable through the centre hold and screwing down the sealing nut, the cable is held in position, centred, waterproofed, strain relieved and automatically adjusted to the size of the cable. This connector is available in black colour and is resistant to salt water, weak acids, weak alkalies, alcohol, ester, keytones, ether, benzine, gas, mineral oil, animal and vegitable oils and can withstand temperature extremes of -35°C to +115°C.



POWER CORD CONNECTOR

Contact: Novoflex Cable Care Systems, Post Box No. 9159, Calcutta 700016.

COST EFFECTIVE WAY TO MICROCOMPUTER DEVELOPMENT



MICROCOMPUTER DEVELOPMENT SYSTEM

PROFESSIONAL - 1

PROFESSIONAL-1 is a low cost Microcomputer Development System designed to facilitate the complete task of the development of the hardware and the software of microprocessor based products. Specifically PROFESSIONAL-1 helps the user in the following tasks.

1. Development of Target Software. :

The software for the target system can be developed on PROFESSIONAL-1 in assembly/high level language thus greatly increasing the programmer productivity. The source programme is stored on mini-floppies and can be easily edited, assembled and listed on the printer. I/O independent routines of the user software can be easily debugged on PROFESSIONAL-1 itself using symbolic debugger.

2. Testing of Target Hardware :

PROFESSIONAL-1 provides a convonient method of testing the user fabricated hardware using the In Circuit Emulator for the particular microprocessor used in the target hardware. Now the entire target hardware can be controlled from PROFESSIONAL-1 through the I.C.E.. The user may exercise the Address/Data/Control bus, calculate ROM sum check and test RAM blocks of the target system from PROFESSIONAL-1. User may also enter diagnostic routines in the memory of the target system and trace their execution or run them at full clock speed to test various sections of the target hardware systematically.

3. Transfer of Assembled Programs to a Prom Programmer

PROFESSIONAL-1 provides RS 232 C serial data link for transfer of data between PROFESSIONAL-1 and an external systems. This data link is used to transfer assembled user programs to PROM Programmer (for example PEP's PP-81) for programming the EPROMs to be used in the target system.

4 Implementation of Software in the Target System :

Implementation of user software in the target hardware is the central problem in the development of any microprocessor based product PROFESSIONAL-1, alongwith In Circuit Emulator facilitates this task greatly.

5. Cost Effective Solution :

Professional-1 is available indigenously at a fraction of the cost of imported Microcomputer Development Systems and you don't have to wait till eternity for delivery and service.

For further details or a demonstration, write to :

PEP
Professional Electronic Products
OPP. OLD OCTROI POST, DELHI ROAD, MEERUT 250002
TEL [illegible] GRAM : PEP

DESI CEN

Book Reviews

The CP/M Handbook with MP/M

By Rodnay Zaks; published by BPB Publications, New Delhi, by arrangement with Sybex Inc., USA; pages 320 (15 cm × 23 cm); soft cover; price: Rs 75.

This book on CP/M and MP/M (control program/multiprogramming control program for microprocessors) is an in-depth, yet objective study of computer commands. Studded with easy-to-understand examples, the book is designed to catch the imagination of novices aspiring to perfect their skills. Even people who are well conversant with CP/M and MP/M will find the book of considerable importance as many versions of CP/M have been defined. An excellent reference guide for business users, input typists, first time computer users and experienced programmers.

—Prem

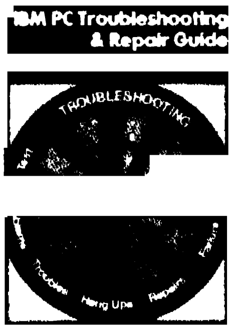
Master Guide to Service ITT Colour TV

By Desai and Desai; published by Jeevandeep Prakashan, Bombay; pages 49 (18 cm × 26 cm); soft cover; price: Rs 25.

With the boom in colour TV production in India, the market has been flooded with various brands of TV sets, most of them using the kits designed by ITT, a West German company. This master guide is a technical manual providing the details for servicing of CTV sets bearing the brand names of ECIL, Keltron, Dyanora, Televista and Uptron—all assembled basically with the ITT kits.

The book has been divided into eight chapters—providing an insight into fault finding, waveform analysis and voltage analysis. Chapter one introduces readers to the PAL colour television system, chapter two explains the block diagram of the ITT-based receiver and chapter three delineates the features of the receiver. Chapter four gives the circuit description of UHF/VHF tuner, AF/IF module, vertical/horizontal deflection, PAL colour decoder and SMPS power supply circuits. Chapters five and six deal with voltage analysis and fault finding in the chassis while chapter seven provides the data sheet for ICs TDA 3560, TDA 1950 and TDA 1035-T used in the circuit. The last chapter deals with fault finding and waveform analysis in PAL decoder using CRD. In addition, the book gives the complete circuit diagram of the ITT-based receiver for the benefit of field service engineers. The book envelopes the complete theory and practical aspects of servicing the ITT colour TV and will prove helpful to CTV service engineers.

—D.G.



IBM PC Troubleshooting & Repair Guide

By Robert C. Brenner; published by BPB Publications, New Delhi, by arrangement with Howard W. Sams and Co. Inc., USA; pages 204 (21 cm × 27 cm); hard cover; price: Rs 180.

This book with a number of schematics, photos and block diagrams will help in identifying the problems easily and in keeping the IBM PC in top operating gear. The simple instructions tell the reader how to fix his personal computer quickly and the easy-to-understand circuit diagrams enable him to make most repairs with few or no tools, quickly zero-in on the malfunctioning components and reduce downtime, amounting to considerable repair saving. The concepts are explained in clear and precise style so as to make electronic troubleshooting both interesting and rewarding. This fully illustrated book is recommended for any one having an IBM PC.

—B.V.R.

Directory of Indian HAMS, 1985

Published by the Federation of Amateur Radio Societies of India, Madras; pages 63 (18 cm × 24 cm); soft cover; price: Rs 10.

This special Indian callbook issue of the federation is a directory of licensed radio amateurs in India. This new edition has been updated till August 1985, the earlier edition having been published in 1982. The book contains over 2100 entries and will be found useful by all amateurs (HAMs) and shortwave listeners (SWLs).

—B.V.R.

Company Profiles

DCM Data Products to expand

DCM Data Products, a division of DCM Ltd, is planning to manufacture electronic teleprinters, dot matrix and daisy wheel printers. Negotiations for technical collaboration with Oki of Japan are in an advanced stage. The company is also developing printed circuit boards for electronic PABXs in cooperation with the Centre for Development of Telematics (CDOT).

The company is introducing two new computers incorporating the latest technology. The Olympic minicomputer based on Intel chip and supported by Xenix software will be marketed commercially in the next two or three months. This will cater for the demand for powerful on-line database oriented systems. The DCM Tandy 1000 colour microcomputer, one of the largest selling models in the world, will offer all features of the IBM-PC plus many more.

As a result of the expansion, the data products division is likely to achieve a turnover of Rs 250 million in the current year ending June 1986. The company has already achieved good progress in areas of energy conservation, modernisation of steel plants, improving safety on railways, ballistic testing for weapons, pollution control, blood analysis in hospitals and global communication network in banks.

ITI to issue bonds

The public sector Indian Telephone Industries (ITI) Ltd will raise Rs 1000 million by issuing one million bonds which will be exempt from wealth tax.

With this the ITI will become the first public sector undertaking to enter capital market with a bond issue. Interest on the 14 per cent secured redeemable non-convertible bonds in the denomination of Rs 1000 will be paid from the date of realisation of the cheques or drafts. Though the bonds are exempt from tax, interest earned on them will be subject to deduction under 80L of the Income Tax Act.

Both cumulative and non-cumulative bonds issued will be transferable by endorsement and delivery. The bonds will be listed on the Bombay, Delhi, Ahmedabad, Bangalore and Kanpur stock exchanges.

Out of one million bonds only half will be offered for public subscription the other half being reserved for private placement with the UTI, the LIC and the GIC.

L&T to give 12% dividend

Larsen and Toubro Ltd has registered a rise of 29 per cent in its income for the year ended September 30, 1985. Sales and other income of the company amounted to Rs 4470 million as against Rs 3460 million in the previous year. Profit before depreciation and taxation has gone up from Rs 467.6 million in 1983-84 to Rs 560.9 million in 1984-85—an increase of 20 per cent. Profit after taxation amounted to Rs 303.3 million as against Rs 232.8 million in the previous year,increase of 29 per cent. The internal generation of funds for the year was Rs 452.0 million as against Rs 356.5 million in the previous year.

As a result, the board of directors of the company has decided to recommend a final dividend of 12 per cent which together with the interim dividend declared in August 1985, amounts to a total dividend of 24 per cent—same as in the previous year. The dividend is covered more than four times by the year's earnings. The board has also recommended issue of bonus shares in the ratio of 3 equity shares for every 5 existing equity shares, subject to the approval of the Controller of Capital Issues.

Meanwhile, the expansion of the company's cement plant capacity at Awarpur to 2.2 million tonnes is progressing satisfactorily and the production is expected to commence by early 1987. The construction of shore-based heavy engineering complex at Hazira, near Surat, is also on schedule.

It has entered into collaboration with Y.E. Data, Japan for the manufacture of floppy disc drives, with Honeywell Information Systems Italia, Italy for the manufacture of dot matrix printers and with Jeumont Schneider, France for the manufacture of electronic PABX. Construction of a new factory for manufacturing these products is nearing completion in the Hebal Industrial Estate, near Mysore.

The company will also undertake the production of mobile cranes at its Kansbahal Works, Orissa in collaboration with Potain Poclain Material, France soon.

Large investment plan by Siemens India

Siemens India has finalised a massive investment of Rs 600 million for the next five years for expansion and modernisation,with a view to becoming a broad-based growth-oriented industrial electronics company.

An electronics factory, proposed to be set up at Nasik in Maharashtra, is expected to be operational in 1987-88. The company proposes to manufacture sophisticated AC and DC drive systems for boilers, chemical units and other industries.

About Rs 200 million have been earmarked for upgradation of the switch gear and another Rs 70 million for modernising the motors factory.

After nearly seven years, the company has received letters of intent for data acquisition, data logging and control systems, process control instrumentation items and protection relays.

During 1985, several new products were introduced in various fields. In the medical engineering field, the company's X-ray diagnostic equipment has been well accepted by hospitals, and agreement has been signed with Fududa of Japan for patient monitoring systems and electrocardiograph machines.

The company proposes to participate in a joint venture with a state development corporation for the manufacture of public switching systems. Discussions are in progress with West Bengal Electronics Development Corporation for manufacturing teleprinters. The cost of the project is placed at Rs 20 million.

In the current year ending September, 1986, the turnover is estimated at Rs 1700 million with a pre-tax profit of Rs 90 million.

Ankur doubles production in first year

Ankur Electronics Limited has doubled its production of plastic TV cabinets in the very first year.

Having achieved this feat, the company has now signed contracts with Weston Electroniks and Sylvania & Laxman to reach its installed capacity which will mean producing one TV cabinet every 1.5 minutes with the hot stamping and printing technology. Two machines are also being acquired from Trusidma & Textima of Europe to attain good quality and precision in moulded plastics.

There has been an overrun in the project cost by Rs 1 5 million To meet the cost overrun and outlay on expansion plans, the company is making a rights issue of Rs 6 million. The company hopes to achieve a turnover of Rs 30 million in 1986 and Rs 60 million in 1987, and is hopeful of declaring a maiden dividend for 1986 itself.

Meanwhile, it has signed a memorandum of understanding with Technicom GmbH, West Germany, along with a non-resident Indian, Mr Ashok Chauhan, chairman of AKC group, for setting up a Rs 150 million sophisticated toolroom project

ESPL's microchip project

The Electronics Systems Punjab Ltd, (ESPL), a subsidiary of the Punjab State Industrial Development Corporation, has launched its data acquisition and control system (DAS) project at Mohali in SAS Nagar Mr Surjit Singh Barnala, chief minister of Punjab, inaugurated the project on January 3.

The project, in which up-to-date technology will be used, has collaboration with the Westinghouse Electric Corporation, USA.

Set up five years ago, the plant has established strong R&D production, quality control and testing facilities.

The range of production of the ESPL is micro and mini computers, data acquisition and control systems and agro dairy instruments. This unit has been approved and has received orders from the Reserve Bank of India, the Union Education Ministry, several universities, engineering colleges and many commercial banks.

Ruchika Electronics poised for big leap

Ruchika Electronics Ltd, a major manufacturer of state-of-the-art electronic products for home and industry in India and abroad, is undertaking an ambitious diversification programme and is likely to enter the capital market this year to raise the funds in part

Already engaged in marketing battery-operated toys in India, the company is spreading its tentacles for making the world's latest electronic toys. The company is already licensed to manufacture black-and-white TV receiver sets (100,000 nos) and colour TV sets (50,000 nos).

A foreign collaborator has already been identified and Ruchika is negotiating with the company for a 100 per cent buy-back arrangement to increase its profitability.

Keeping the future expansions in view, the company has applied for industrial licence to manufacture electronic toys, radio cassette recorders, VCRs and VCPs (in all 200,000 pieces per annum). This ambitious profile of the company is backed by a good financial base, livewire R&D source and an extensive sales network throughout the country.

PDDL's colour picture tube project

The foundation stone for the country's first colour picture tube project was laid by Mr Surjit Singh Barnala, Punjab's chief minister, on January 13

A joint venture by the Punjab Display Divices Limited (PDDL), a subsidiary of the Punjab State Industrial Development Corporation, and the Jagatjit Cotton and Textile Mills (JCT) Ltd, the plant is to be set up at Mohali, in SAS Nagar. The colour picture tubes, so far being imported, will now be made here—thus accounting for a respectable foreign exchange saving besides helping in bringing down the CTV prices.

The plant, complete with robots, is expected to be commissioned in 18 months' time The Rs 750 million project will manufacture half-a-million colour picture tubes every year in technical collaboration with Hitachi of Japan—the world leaders in CTV technology.

PDDL will start with a 51cm tube, with inline gun specially characterised to improve focus The tube will be coated with black matrix strip screen using green, blue and red phosphor pigment to improve the brightness and contrast. The tube is coated using a special technique to limit the flashover currents.

The deflection yoke mounted in the tube has a very low power consumption. It does not require any pin cushion correction. Progressively the company proposes to manufacture mini-neck and super mini-neck tubes. Improvements in glass bulb in aspect ratio and a square tube with flatter screen would also be introduced progressively.

Mahendra's tie-up with Austrian firm

Mahendra Electronics has concluded a contract with Futurit of Austria, for manufacture of traffic equipment worth Rs 100 million. The contract was signed at Pragati Maidan by Mr Philippe S. Pezet, export manager, Futurit and Mr Balram K. Mahendra, president, Mahendra Electronics.

Futurit has introduced the application of microprocessor technology in traffic controlling, railway signalling etc. It is also a world market leader in the supply of unbreakable polycarbonate traffic lights. Thus, traffic control is expected to take a quantum leap in India with the indigenous manufacture of computerised traffic controllers based on Futurit's technology.

The CRRI and the Delhi Traffic Police have given permission to instal Futurit's equipment at an intersection in Delhi. A study of the benefits of microprocessor technology in improving traffic flow, reducing accidents, reducing fuel consumption by increasing duration of the green light is being undertaken by CRRI.

A new design of double lens unbreakable polycarbonate which increases signal visibility tremendously, even under unfavourable weather conditions, is being engineered by Futurit for use in high-speed railway track systems

Superphone India to make EPBAX

Superphone India Pvt Ltd, a premier telephone exchanges and intercoms manufacturing company, is setting up a Rs 50 million project near Bombay to manufacture electronic private branch exchanges (EPBAX).

For this purpose, the company is collaborating with Oki Electronics of Japan. The company has planned to enter the capital market in the middle of this year to raise part of the 50,000 lines capacity project cost. It is likely to issue shares worth Rs 15 million for the purpose.

Production is expected to start by the end of the year with an initial production capacity of 10,000 lines and attain the rated capacity of 50,000 lines by the end of the third or fourth year.

Superphone India is one of the 12 firms that have received letters of intent for the manufacture of EPBAX. The company has considerable experience in the analogue PABX systems and has installed 50 such systems all over the country.

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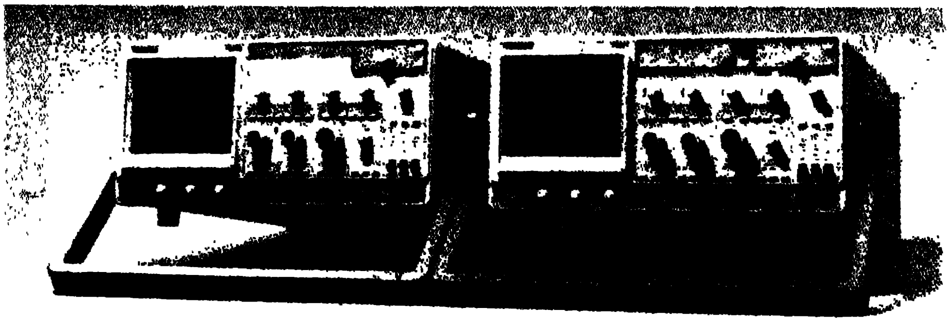

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Frequency Counter

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Display with 200MHz Bandwidth
CRT Readout
DVM (AC, DC, P-P Voltage)
Frequency Counter

CRT READOUT OSCILLOSCOPE COM 7100
Sensitivity 5mV/DIV, DC-100MHz
Max. Sweep Time 2 ns/DIV, 4 Channel
Display with 100MHz Bandwidth
CRT Readout
DVM (AC, DC, P-P Voltage)
Frequency Counter

CRT READOUT OSCILLOSCOPE COM 7060
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Max. Sweep Time 5ns/DIV, 4 Channel
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LICENCES AND LETTERS OF INTENT

The following licences and letters of intent were issued to electronics firms under the Industries (Development & Regulation) Act, 1951 during the months of August and September 1985

Name & Address of the Applicant and location of the undertaking	*Date & type of licence*	*Article*	*Quantity per annum*
(1)	*(2)*	*(3)*	*(4)*
LICENCES			
Bharat Electronics Ltd Trade Centre 29/4 Race Course Road Bangalore 560001 (Bangalore-Karnataka)	1 8 85 (NA)	Vacuum switching devices	10,000 r
Madhya Pradesh State Electronics Development Corporation Ltd B-1/154, Arera Colony Bhopal 462016 (Distt Raisen Madhya Pradesh)	1 8 85 (NU)	Colour TV receiver sets	
Max Magnetics Pvt Ltd 70/3 Industrial Area Umbergam 396171 (UT Dadra and Nagar Haveli)	7 8 85 (NU)	Audio magnetic tapes	1080 MHM × 6 3 mm
Videcoon International Ltd 2275 Adat Bazar Ahmednagar 414001 (Distt Aurangabad Maharashtra)	13 8 85 (NU)	1 Colour TV receiver sets 2 Black-and-white TV receiver sets	40,000 nos 10,000 nos
O/E/N Micro Systems Ltd Vyttila, Tripunithura Road Cochin 682019 (Distt Ernakulam Kerala)	14 8 85 (NA)	Micro motors/step per motors	2,00,000 nos
Uniscans & Sonics Limited 107-110, Sector 17-B Chandigarh 160017 (Distt Patiala-Punjab)	14 8 85 (NU)	1 Brain scanners 2 Body scanners	6 nos 24 nos
Sidkel Televisions Ltd Keltron House Vellayambalam Trivandrum 695001 (Distt Mallapuram-Kerala)	26 8 85 (NA)	Colour TV receiver sets	10 000 nos
Hindustan Teleprinters Ltd GST Road, Guindy Madras 600032 (Distt Dharmapuri-Tamil Nadu)	29 8 85 (NU)	Electronic teleprinters with option accessories variants and related generic equipment	800 machines
Naresh Chand Jain 150 DDA Office Complex Jhandewalan Phase-1 New Delhi 110055 (Dist Alwar-Rajasthan)	3 9 85 (NU)	Fluorescent tubelights	4 million nos
Bharat Electronics Ltd 'Trade Centre 29/4 Race Course Road Bangalore 560001 (Distt Bangalore-Karnataka)	5 9 85 (SE)	Television picture tubes	3 00 000 nos (after expn)
Electronic Corpn of India Ltd Industrial Development Area Cherlapalli Hyderabad 500762 (Distt Ranga Reddy-Andhra Pradesh)	5 9 85 (NA)	Thick film devices	6,00,000 nos
Electronics Corpn of India Ltd Industrial Development Area Cherlapalli Hyderabad 500762 (Distt Ranga Reddy-Andhra Pradesh)	9 9 85 (SE)	Microwave antennae for satellite communication	50 nos (after expn)
Indian Telephone Industries Ltd 16, Museum Road Bangalore 560001 (Distt Allahabad-Uttar Pradesh)	11 9 85 (NA)	Multi-access rural radio equipment consisting : 1 Exchange end terminals/equipment 2 Base radio equipment 3 Subscriber radio equipment 4 Radio repeater equipment 5 Subscriber radio repeater equipment	Rs 30 million ex-factory turn-over value
J K Batteries (A Division of Straw Products Ltd) Jaykaypur 765017 Rayagada Orissa (Bhopal-Madhya Pradesh)	12 9 85 (SE)	Dry battery cells	120 million no (after expn)
Electronic Research Pvt Ltd 17th KM, Old Madras Road Bangalore 560049 (Distt Bangalore-Karnataka)	13 9 85 (NU)	1 Deflection components for colour TV receivers comprising deflection yoke, flyback transformers, purity magnet and focus resistor potentiometer pack 2 Electronic tuner for colour TV receivers	1 million sets
AAG Rola Magnetics Pvt Ltd 147 Poonamallee High Maduravoyal Madras 602102 (Distt Chingleput-Tamil Nadu)	17 9.85 (SE)	Ferrite magnets	1000 tonnes (after expn)
Ralectronics Pvt Ltd Farah Commercial Complex 26-J C Road Bangalore 560002 (Yeshenthpur-Karnataka)	20 9 85 (NA)	1 Black-and-white TV receiver sets 2 Colour TV receiver sets	40,000 nos 50,000 nos
Gujarat Industrial Investment Corpn Ltd Chunibhai Chambers Behind Deepali Cinema Ashram Road Ahmedabad 380009 (Distt Ahmedabad-Gujarat)	24 9 85 (NU)	Nickel cadmium cells/batteries (button, cylindrical, rectangular type and for defence purposes)	1 million pcs
Bharat Electronics Ltd Trade Centre' 29/4 Race Course Road Bangalore 560001 (Distt Bangalore-Karnataka)	27 9 85 (NA)	Liquid crystal displays	1 million nos
Teletronix Ltd Bhimtal, Distt Nainital Uttar Pradesh 263136 (Distt Nainital-Uttar Pradesh)	30.9 85 (COB)	Black-and-white TV receiver sets	20,000 nos.
LETTERS OF INTENT			
Instrumentation Ltd Kota Jalawar Road, Kota Rajasthan 324005 (Distt Kota-Rajasthan)	5 8 85 (NA)	Microprocessor based distributed digital control systems	Rs 100 million
United Diamonds Ltd 'United House', 107-110 Sector 17-B Chandigarh (Distt Raisen-Madhya Pradesh)	5 8 85 (NU)	1 Black-and-white TVs 2. Colour TVs	50,000 nos. 50,000 nos.
Punjab Communication Ltd C-30 Phase-II, Industrial Focal Point SAS Nagar, Punjab (Distt Ropar-Punjab)	5 8 85 (NU)	Analogue digital multiplex trans converter (trans multiplexer type)	200 nos

(1)	(2)	(3)	(4)
Gujarat Communications & Electronics Ltd Anurag Commercial Centre Race Course Baroda 390005 (Distt Baroda-Gujarat)	5 8 85 (NA)	Low capacity low cost satellite communication terminals	20 terminals
Escorts Electronics Ltd Escorts House, Roshnara Road Delhi 110007 (Distt Faridabad-Haryana)	6 8 85 (NU)	1 Electronic tuners for colour TV	1 million
		2 Deflection yoke for colour TV	0 5 million
		3 Fly back transformer for colour TV	0 5 million
Kirloskar Electric Co Ltd Industrial Suburb, Rajaji Nagar Bangalore 560010 (Distt Mysore-Karnataka)	6 8 85 (NA)	Micro/minicomputer	Rs 100 million
Indian Reprographic Systems Pvt Ltd 1st Floor, Plaza Cinema Building Connaught Place New Delhi 110001 (Distt Meerut-Uttar Pradesh)	7 8 85 (NA)	Electronic telephone instrument	2,00 000 nos
Larsen & Toubro Ltd L&T House, Narottam Morarji Marg Ballard Estate Bombay 400038 (Distt Mysore-Karnataka)	9 8 85 (NU)	Electronic test and measuring instruments	4 700 nos
Punjab State Electronics Dev & Production Corpn Ltd 2nd Floor, Bank of India Building Sector 17-B Chandigarh (Distt Ropar-Punjab)	12 8.85 (NU)	Lithium batteries	10 million (3 volts one amp-hour equivalent cells)
Dowell's Elektro Werke Satguru Estate, Off Aarey Road Goregaon East Bombay 400063 (Bombay-Maharashtra)	12 8 85 (NU)	1 Copper cable socket connectors	1050 tonnes
		2 Copper flats, strips and components	
DCM Ltd (Unit of DCM Data Products) Bara Hindu Rao Delhi 110006 (Distt Solan-Himachal Pradesh)	12.8 85 (NU)	Electronic telex machine	5000 nos
Escorts Electronics Ltd Escorts House, Roshnara Road Delhi 110007 (Backward area in Haryana)	19 8 85 (NU)	1 Carbon potentiometers	7 million nos
		2 Carbon potentiometers with switch	1 million nos.
		3 Single slide potentiometers	1 million nos
		4 Dual slide potentiometers	1 million nos
		5 Cermet potentiometers	1 million nos
		6 Carbon presets	1 million nos
		7 Wire-wound potentiometers	1 million nos
		8 Plastic conductive-coating potentiometers	1 million nos
Dinesh K Srivastava C/o Mr G K. Rajagopalan C-320, Defence Colony New Delhi 110024 (Distt Nainital-Uttar Pradesh)	21 8.85 (NU)	Microprocessor based communications controllers	Rs 30 million
BEE Electronics Machine Pvt Ltd 256, Dr A B Road, Worli Bombay 400025 (Distt Thane-Maharashtra)	21 8 85 (NU)	Fascimile equipments	2000 nos
Basu John Vetteth s-Jagannathan 92 Poes Garden Road Madras 600018 (Distt Chingleput-Tamil Nadu)	21 8 85 (NU)	Minicomputer/micro-processor based systems	Rs 60 million
Goodwill Electronics & Engg Co Pvt Ltd 414-New Delhi House 27 Barakhamba Road New Delhi 110001 (Delhi)	21 8 85 (NU)	Minicomputer/micro-processor-based systems	Rs 60 million
Debikay Technologies Pvt Ltd 5-323-A Panchsheel Park New Delhi 110007 (Distt Ghaziabad-Uttar Pradesh)	21 8 85 (NU)	Fascimile equipments	2000 nos
Rane Brake Linings Ltd Maithri, 32 Cathedral Road Madras 600086 (Any permissible area in Tamil Nadu)	21 8.85 (NU)	Fascimile equipments	2000 nos
Suresh Shrivastava VI II Manicol Campus Kotla Lane New Delhi 110002 (Distt Bahraich Uttar Pradesh)	21 8 85 (NU)	Electronic micropro-cessor based control instrumentation comprising transmitters recorders and controllers	Rs 100 million
T S Grewal 20 Lodhi Estate New Delhi 110003 (Distt Dehradun-Uttar Pradesh)	23 8 85 (NU)	Minicomputer micro processor based systems	Rs 100 million
Methodex Systems Pvt Ltd 607 608 Meghdoot, Nehru Place New Delhi 110019 (Distt Indore-Madhya Pradesh)	23 8 85 (NA)	Minicomputer micro processor based systems	Rs 30 million
Instrumentation Ltd Kota Jalawar Road Kota 324005 (Distt Kota Rajasthan)	23 8 85 (NA)	Uninterruptible power supply systems of capacities 02 KVA to 500 KVA	Rs 85 million
Best & Crompton Engineering Ltd 29 Rajaji Salai Madras 600001 (Distt Chingleput Tamil Nadu)	23 8 85 (NU)	Solar thermal systems for domestic commercial and industrial applications	1000 systems using 25,000 sq mtrs of collectors
T S Grewal 20, Lodhi Estate New Delhi 110003 (Distt Dehradun-Uttar Pradesh)	23 8 85 (NU)	1 Colour TV receiver sets	50 000 nos
		2 Black-and white TV receiver sets	50 000 nos
Kundandas Harikrishandas Sadarangani C/o Royal Electronics Pvt Ltd 46/1 Kangrali B K Market Yard Road Belgaum Karnataka (Distt Belgaum-Karnataka)	30 8 85 (NU)	1 Black and white TV sets	10 000 nos
		2 Colour TV sets	20 000 nos
Punjab State Electronics Dev & Production Corpn Ltd Bank of India Bldg, 2nd Floor Sector-17B Chandigarh 160017 (Distt Ropar-Punjab)	30 8 85 (NU)	Minicomputer/micro processor based systems	Rs 200 million
Incomnet India Ltd B-102 Phase-VIII, Industrial Area SAS Nagar Punjab 160051 (Distt Ropar-Punjab)	30 8 85 (NA)	Minicomputer/micro-processor based systems	Rs 60 million
Essen Peripherals Pvt Ltd 7 G, IDC Electronics Complex Gandhinagar Gujarat (Distt Gandhinagar-Gujarat)	30 8 85 (NU)	Winchester disc drives and catridges disc drives	Rs 60 million
Machinery Manufacturers Corpn Ltd Gateway Bldg, Apollo Bunder Bombay 400039 (Calcutta-West Bengal)	30 8 85 (SE)	Matrix printer	Rs 50 million (after expn)
Indo Swing Ltd Narasapur Road, Balanagar Hyderabad 500037 (Andhra Pradesh)	30 8 85 (NU)	Minicomputer/micro processor based systems	Rs 100 million
Magnetic Information Technology Ltd B-100 Phase-VIII, SAS Nagar Punjab 161051 (SAS Nagar-Ropar-Punjab)	30 8 85 (NU)	Floppy disc drive and its sub-assemblies (5¼" half weight and 3½")	1,25 000 units
Hindustan Brown Boveri Ltd Brown Boveri House Race Course Circle Baroda 390007 (Bombay-Maharashtra)	6 9 85 (NU)	Minicomputer/micro processor based systems	Rs 100 million
Machinery Manufacturers Corporation Ltd Gateway Building, Appollo Bunder Bombay 400039 (Calcutta-West Bengal)	6 9 85 (NA)	Microprocessor based computer systems	Rs 100 million
Crompton Greaves Ltd 1, Dr V B Gandhi Marg Bombay 400023 (Distt Dhar Madhya Pradesh)	6 9 85 (NU)	Electronic telephone instruments	2,00,000 nos
Vimal Nanda B-III Malviya Nagar	9 9 85 (NU)	1 Black-and-white TV TV receiver sets	.00,000 nos

(1)	(2)		
New Delhi 110017 (Distt Gaziabad Uttar Pradesh)		2 Colour TV receiver sets	50,000 nos
The Punjab State Industrial Development Corpn Ltd S C O 54-56 Sector 17 A Chandigarh 160017 (Ropar-Punjab)	9 9 85 (NU)	1 Hard disc drives 2 Floppy disc drives 3 Dot matrix printers 4 Daisy wheel printers	Rs 275 million
Multitech International Ltd 8A, Atma House, 1, Tolstoy Marg New Delhi 110001 (Dehradun Uttar Pradesh)	11 9 85 (NU)	Microcomputer/ microprocessor based systems	Rs 200 million i value
International Computers Indian Manufacture Ltd Ahmednagar Road, Mile Post No 4 Pune (Distt Pune-Maharashtra)	30 9 85 (NU)	Minicomputer/micro processor based systems	Rs 240 million in value
J&K State Industrial Development Corpn Ltd Drabu House Ram Bagh Srinagar (Distt Jammu Jammu & Kashmir)	30 9 85 (NU)	Uninterruptible power supply systems	
Instrumentation Limited Kota-Jalawar Road, Kota Rajasthan 324005 (Distt Kota Rajasthan)	30 9 85 (NA)	Drives (all types like winchester, hard disc floppy disc etc of all sizes) Printers (all types like daisy wheel, line dot matrix etc) Key boards, display terminals	Rs 250 million value
Vishesh Technical & Management Services Pvt Ltd 653 11th Main Road HAL Second Stage Bangalore 560038 (Distt Tumkur-Karnataka)	30 9 85 (NU)	Dot matrix printers and daisy wheel printers	Rs 250 million in value
Kartar Singh Thakral C/o Dr N I Hingorani, R J Consultants P Ltd 3-A Mehar House, 1st Floor 15 Cawasji Patel Street Fort Bombay 400001 (Any permissible location in the state of Karnataka)	30 9 85 (NU)	1. Mini computers/ microprocessor based systems 2 Calculators	Rs 30 million in value 2,00,000 nos
Auto controls (P) Ltd 414 New Delhi House 27 Barakhamba Road New Delhi 110001 (Any permissible area in Delhi)	30 9 85 (NU)	Minicomputer/micro processor based systems	Rs 60 million
Ambrish Kumar Bansal 2/31 Ansari Road, Daryaganj New Delhi 110006 (Any permissible location in Uttar Pradesh)	30 9 85 (NU)	Modems	10,000 nos
B D Aggarwal & Sons (P) Ltd 29-30 Vasvani Mansion 120, Dinshaw Vachha Road Bombay 400020 (Delhi)	30 9 85 (NU)	Colour television receiver sets	50,000 nos
The Economic Development Corporation of Goa, Daman & Diu Ltd Trinora Apartments, Near El derade Theatre P B No 316, Panaji Goa 403001 (Goa Daman & Diu)	30 9 85 (NU)	1 Electronic digital document 2 Transmission equipment 'facsimile'	
J&K State Industrial Development Corpn Ltd Drabu House, Rambagh Srinagar, (Distt Budgam-Jammu & Kashmir)	30 9 85 (NU)	VHF mid band communication sets	Rs 30 million in value

LICENCES AND LETTERS OF INTENT CANCELLED

Name of Undertaking	*IL dated*	*Articles*
LICENCES CANCELLED		
Ambalal Sarabhai Enterprises Ltd Baroda	15 3 73 (Revoked)	Television receivers
Ambalal Sarabhai Enterprises Ltd Baroda	3 11.67 (Revoked)	Television receivers
LETTERS OF INTENT CANCELLED		
Surya Prakash Srivastava Saubhagyavati Industries Jaipur	3 3 84 (Cancelled)	Electronics components chemically milled
R C Exports Pvt Ltd Bangalore	14 10 82 (Cancelled)	Digital blood pressure instruments and digital human thermometer
Orr cee Electronics Ltd Bangalore	16 1 82 (Cancelled)	Printed circuit board for 100% export
S A Software Technology Pvt Ltd New Delhi	30 6 84 (Cancelled)	Development of computer software
Delview Electronics (P) Ltd New Delhi	29.7 84 (Cancelled)	Pre-recorded video cassettes
Kothari Electronics & Industries Ltd Madras	1 11 83 (Cancelled)	Colour TV receiver sets
S D Gupta W-63 Greater Kailash 2 New Delhi	22 3 82 (Cancelled)	Printed circuit board etc
Indus Technologies Inc Monroeville, PA 15146 USA	28 2 85 (Cancelled)	Computer software
Ralectronics Pvt Ltd Bangalore	2 2 85 (Cancelled)	Black-and-white TV sets
Ralectronics Pvt Ltd Bangalore	23 9.83 (Cancelled)	CTV sets
Punjab State Industrial Development Corpn Ltd Chandigarh	20 4 81 (Revoked)	TV glass shells
Mitgart India Ltd SAS Nagar Punjab 161051	31 12 83 (Cancelled)	Magnetic cores & ceramic components etc
Crompton Greaves Ltd Bombay	4 4 82 (Cancelled)	Static AC variable speed drive system

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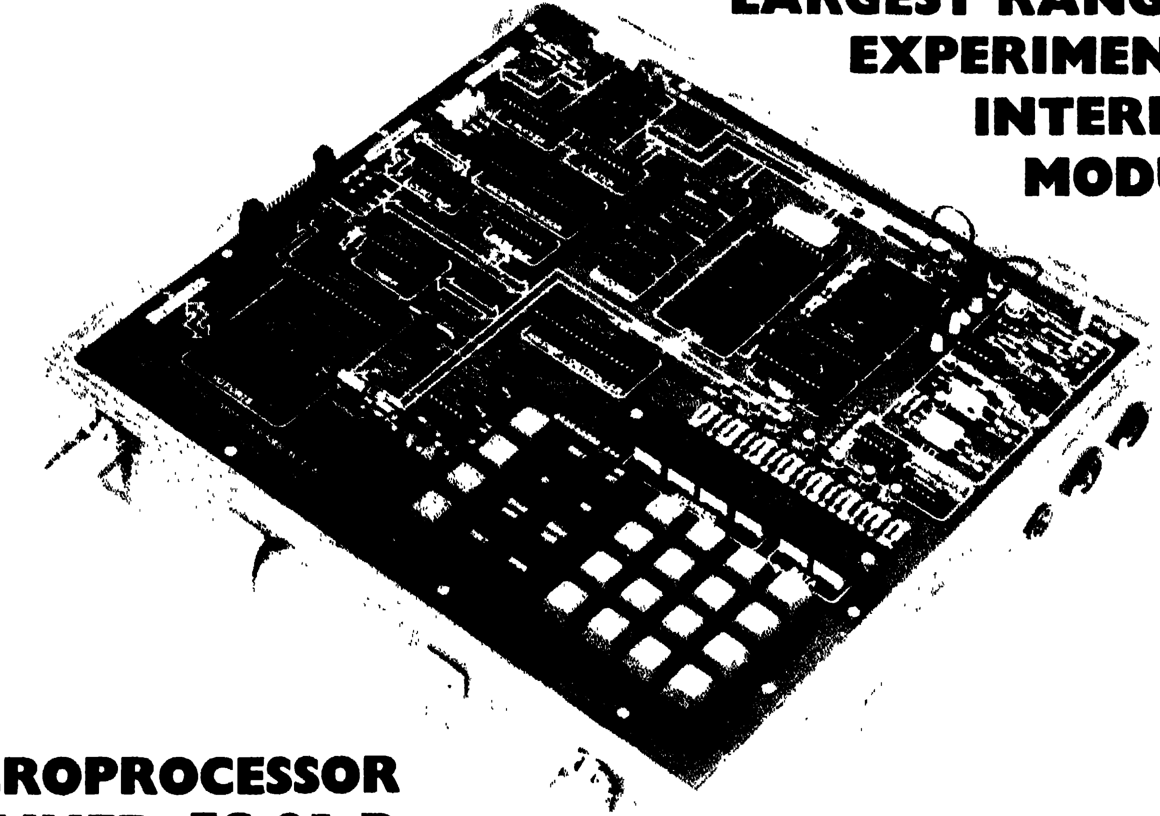

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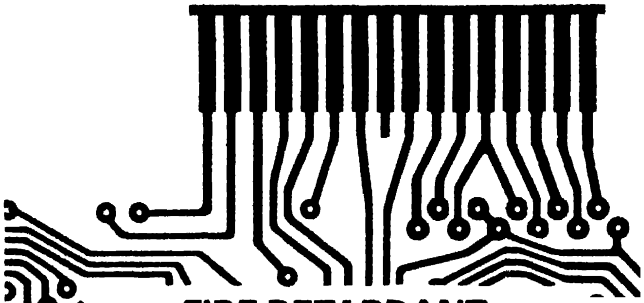

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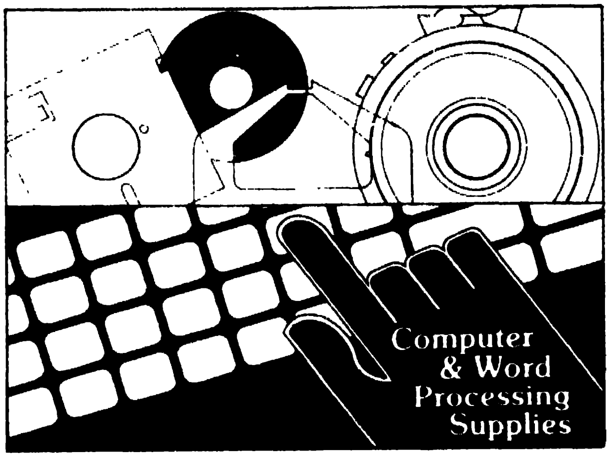

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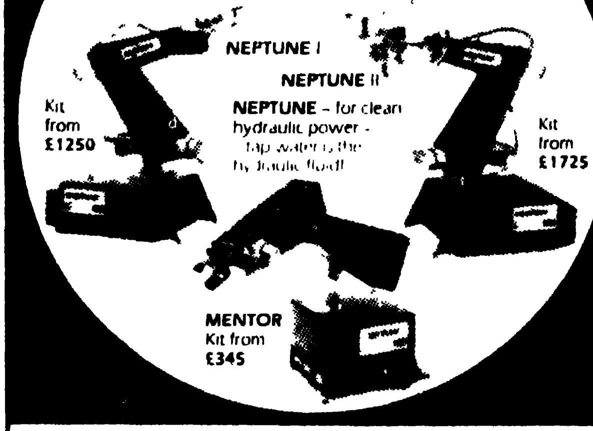
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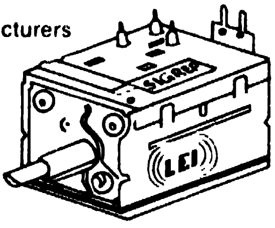

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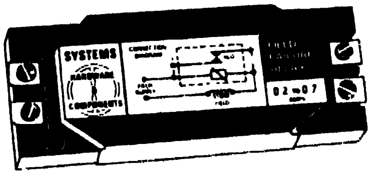

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50	UHF TV Preamp	8	
51	TV Pattern Generator	16	600
52	TV Games (4 games) Built your own TV	15	
53	Musical Door Bell	6	65
54	Electronic Horn for Car	5	75
55	Walkman Disco Light	2	30
56	IC Disco Light Star Figure	7	60
57	Mosquito Reppeller	3	35
58	Light Dimmer	3	75
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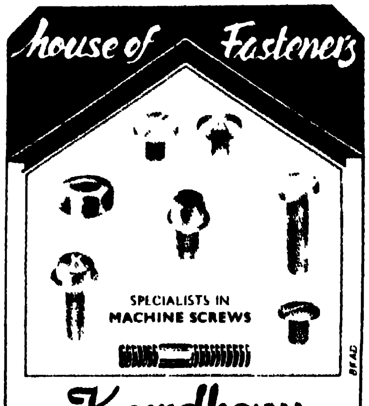

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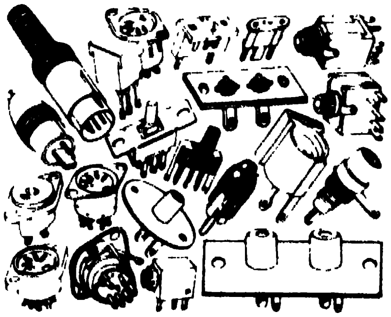

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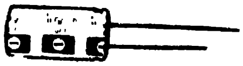

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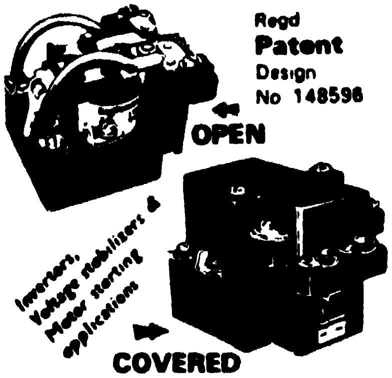
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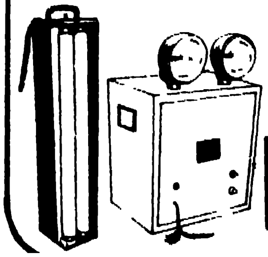

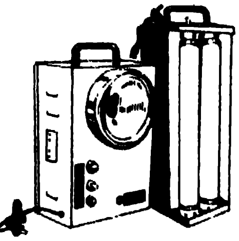

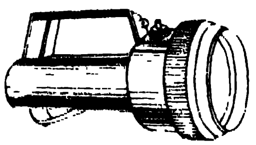

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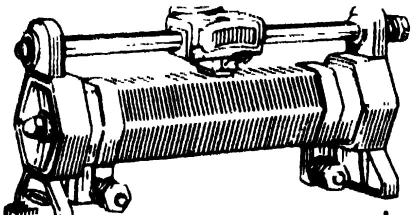

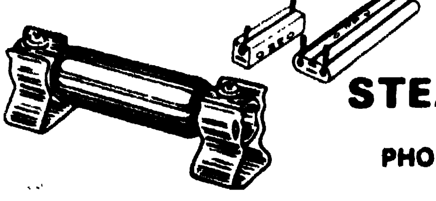

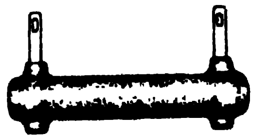

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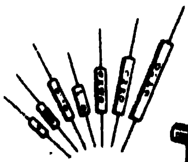

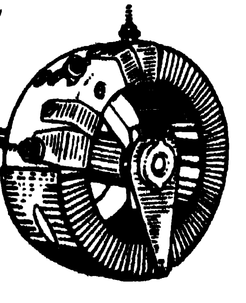

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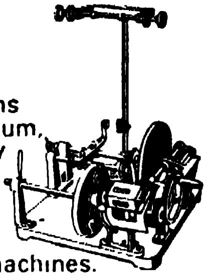

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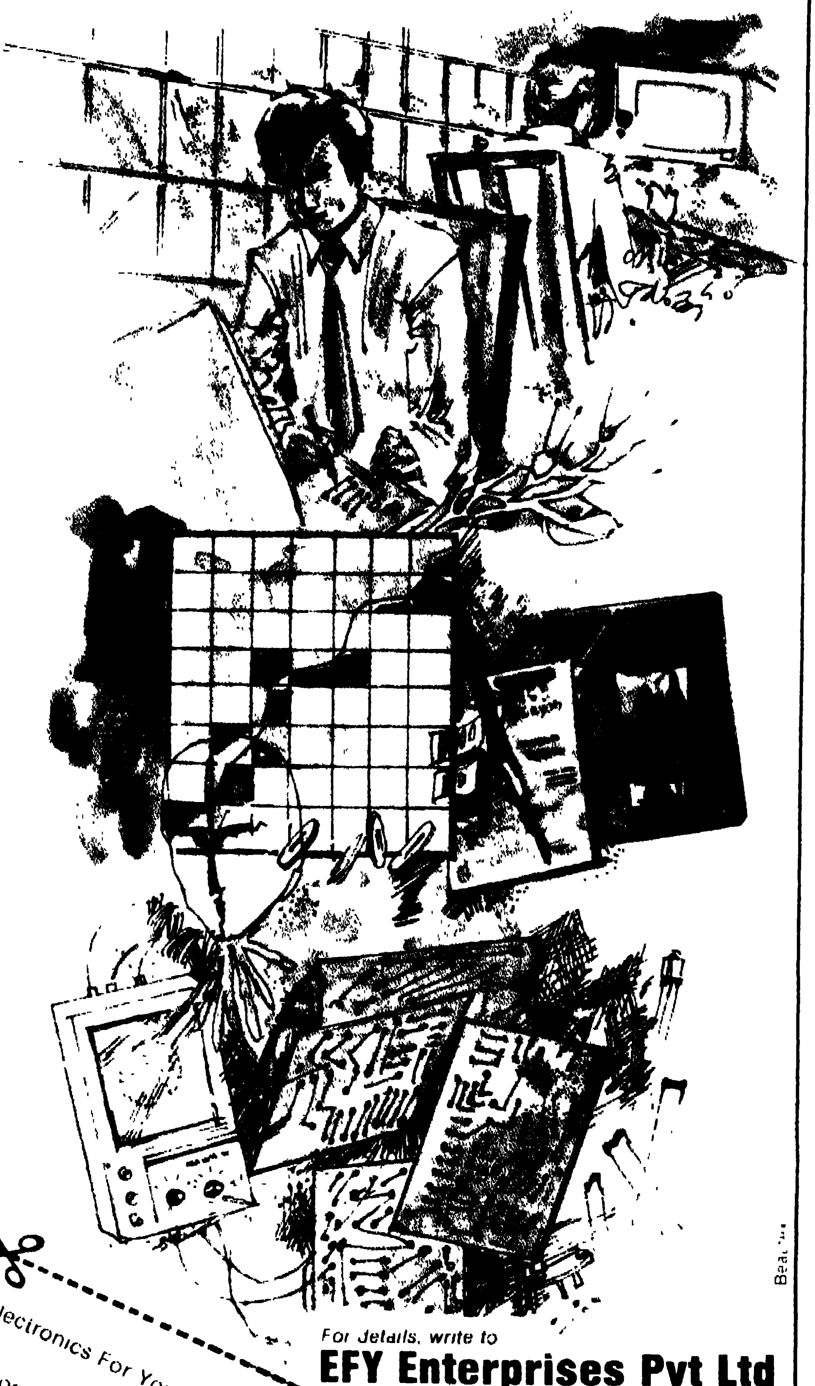

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JULY 1986

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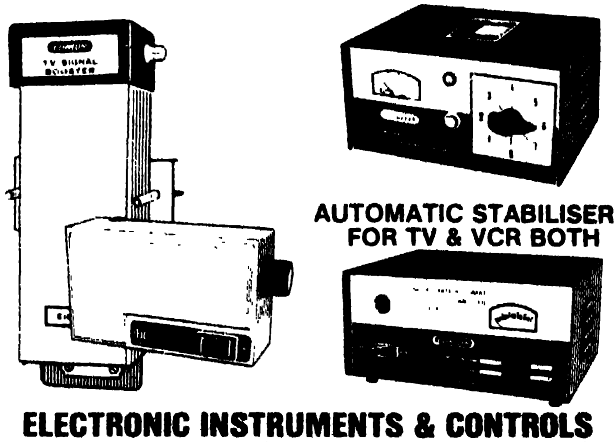

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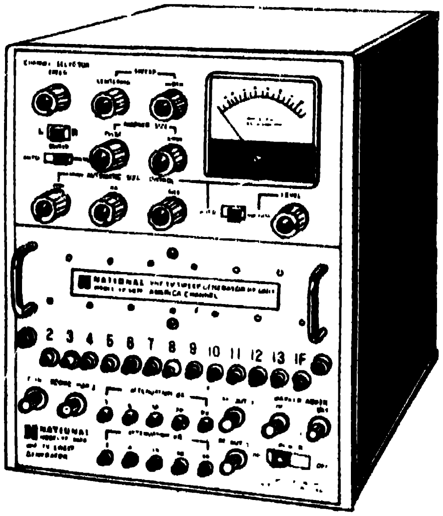

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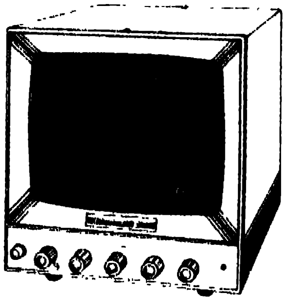

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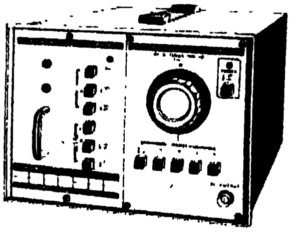

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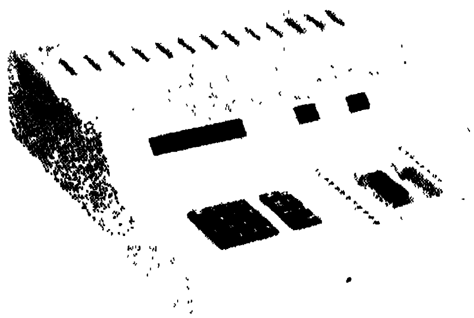

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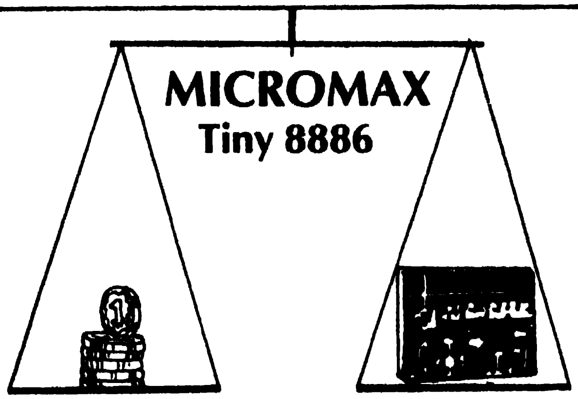

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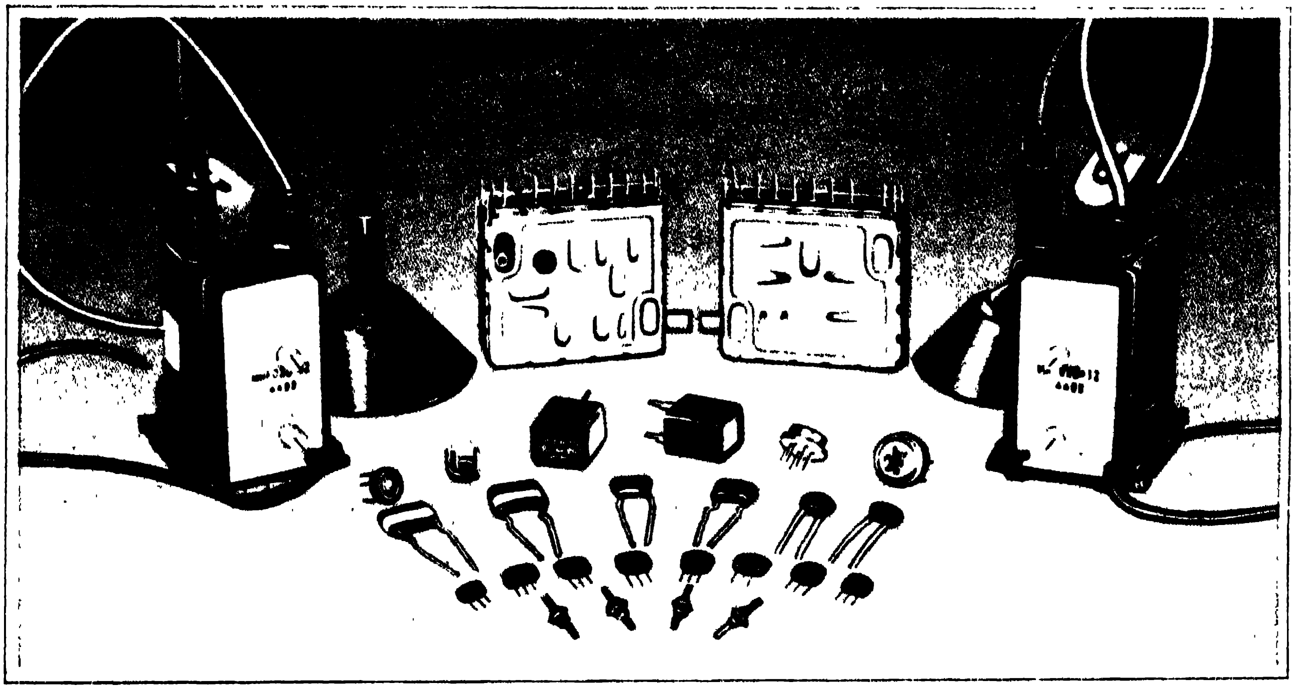

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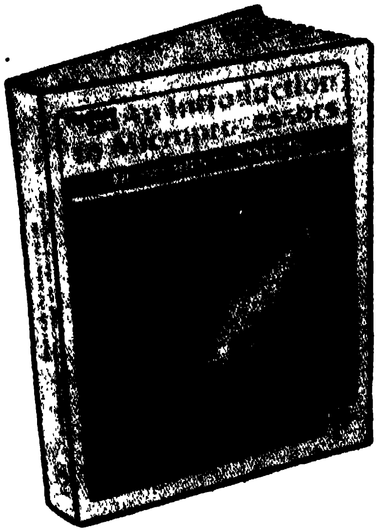

AN INTRODUCTION TO MICROPROCESSORS
FROM CHIPS TO SYSTEMS

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Are you intrigued by the mystery and power of microprocessors? This beautifully illustrated edition of a SYBEX bestseller takes you on a fast-paced adventure through the fundamental concepts and inner workings of a microcomputer. All aspects of microprocessors and related components are described in easy-to-understand terms. internal operation, memories, peripheral chips, system interconnect, microprocessor applications, programming, interfacing and system development

This book is written for everyone who wants to understand how a microprocessor operates and how a complete system is assembled from chips. In particular, it is an important resource for students, scientists, and engineers, · well as the nontechnical reader. Surprisingly, no preliminary knowledge of computer or microprocessor technology is needed to understand this book The concepts are carefully defined, each in turn, and the next is presented in a simple and progressive way

The information presented is applicable to any microprocessor although many specific examples are given You are introduced to concepts and design principles common to all microprocessors You are given the standard rules of design and shown how they apply to various microprocessors. You are shown both the differences between various microprocessors, and the advantages and disadvantages of specific microprocessors

This book is organised to introduce you quickly and effectively to the inner workings of a microprocessor It will help you understand how a microprocessor works, even if you have had no prior experience with electronics

Its chapter provides you the basic definition to understand microprocessor, takes you inside the microprocessors, examines the other components that make up a complete system from the memory chips, advantages and disadvantages of the various microprocessors available, how to put together a system easily and rapidly, main application areas for microprocessor connecting the system to the outside world and programming it (interfacing techniques, microprocessor programming assembly and high-level programming), techniques necessary for connecting the main input/output devices and peripherals, basic definition and techniques for programming microprocessor resources available in assembly language and survey high level language tools available for efficiently developing a system and also forecasts future developments.

Microprocessor technology has beocme an essential component of the industrial world today. It is the author's contention that it is possible to learn about microprocessors in a short time. This book represents a step in that direction

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CONTENTS

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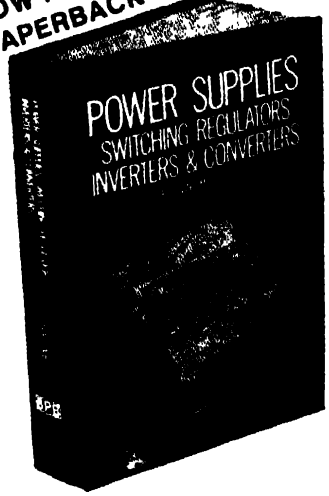

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Nowhere else can you find such a wide range of related technical data and practical applications of electronic equipment operating power. Whether you are building a homebrew radio transmitter, adding hardware capabilities to your computer, or are involved in state-of-the-art electronic design, you can count on finding exactly the advice and information you need. Plus, you will get hands-on-experience working in inverter, converter, and power supply circuitry with the wealth of circuit diagrams (many with parts lists) included here

With such a large portion of today's electronic equipment deriving their operating power from regulated supplies using inverters and converters—TV sets, radio transmitters, computers, electronic ovens, and more—you owe it to yourself to stay in step with all the latest developments. This exceptional guide-book gives you both technical data and practical applications in one power-packed volume.

CONTENTS

CHAPTERS. Introduction. Inverters and Converters An Overview. Theory. Inverter and Converter Design. Transistor Inverter and Converter Applications. Thyristor Inverter and Converter Applications. Switching-Type Power Supplies. An Overview. Theory. Switching-Type Power Supplies. Noise Considerations. Switching AC Voltages. Switching DC Voltages. Passive Switching Components. Semiconductor Switching Components. Voltage References and Comparators. Switching Regulator Design. Rectifier Circuit Design. Switching-Type Power Supply Applications. Appendix A Greek Symbols. Appendix B Voltage or Current Ratios vs. Power Ratio and Decibels. Index.

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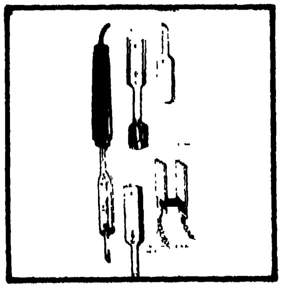
Amateur Radio Regulations

23 Amateur radio is becoming increasingly popular as a hobby in India yet few have complete knowledge about the government rules and regulations in this regard. This article familiarises prospective hams with such policies and advises them how to import their hamming equipment.

—Ashok Baijal, VU2AEY

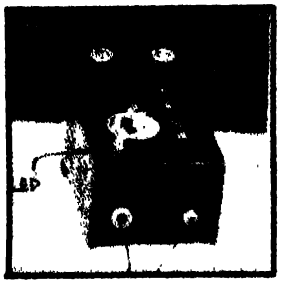
A Zero-Cost, Infinite-Life Soldering Iron



46 Most electronic experimenters usually have a vast collection of burnt out soldering irons—generally a result of the wide variations in the supply voltages in metropolitan cities. This article describes a method for reconditioning damaged soldering irons so that hobbyists can experiment without fear of failure.

P. Narasimha Rao

Envelope Follower for Guitars and Organs



80 It is very difficult for amateur guitarists to obtain electronic gadgets since they are not made locally. This project for an envelope follower produces an effect similar to wah-wah, except that it is automated. Though designed for guitars, it is equally suitable for organs.

—D. Gowdama Chandran

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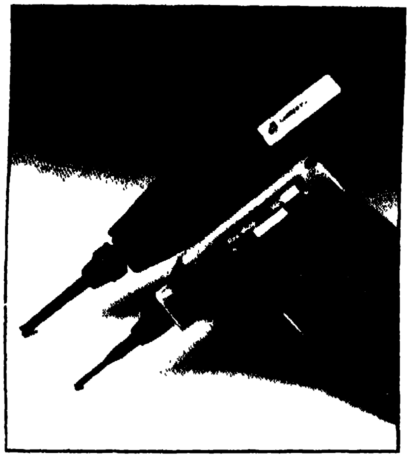
Your right connection for solder and solderless connections

The Cooper Group, Germany offers
reliable Soldering, Desoldering and Wire-Wrap tools.



Wire wrap tools

Gardner Denver Wire-Wrap tools are designed for high-density solderless interconnections as per international standards DIN 41611, IEC 352, MIL-STD 1130. Range includes :

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- 14 G1 Series light weight, mains operated wire-wrap tools for miniwrap application
- 14 R2 Series battery powered, wire-wrap tools for field repair
- 34 AWG pneumatic wire-wrap tool for high-density interconnections
- 14 YM1 Series pneumatic wire-wrap tools for horizontal wrapping
- 14 YP1 Series air powered tools for continuous high production use

Soldering stations

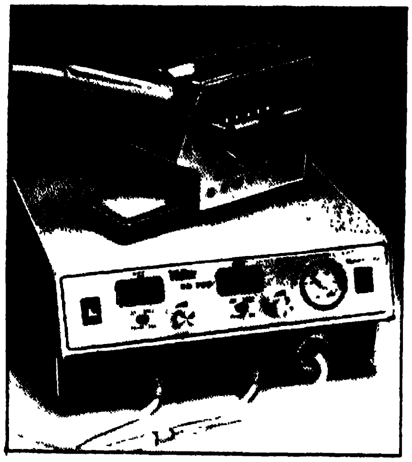
Weller WECP-20 temperature-controlled Soldering Station is for safe soldering of highly sensitive electronic components and quality assembly of PCB's.

Weller EC2002 Soldering Station is meant for ultra sensitive soldering jobs in research and development work which demand continuous monitoring of working temperature digitally.

Weller WMCP - EC miniature soldering Station is for micro-electronics jobs.

Weller AG 700 hot air station is for soldering of flat packs, to wire wrap posts, and shrinking of insulating tubes.

Weller Heat-a Print station is for soldering and desoldering of hybrid circuits.



Desoldering station

Weller DS701 Desoldering and Soldering Station is designed for soldering and desoldering of sensitive MOSFET IC's without risk of damaging them.

Weller VP 801 EC Desoldering Station has built in vacuum pump. Nine different desoldering nozzles handle all types of desoldering jobs including desoldering of flat-pack (two sided) IC's and quad-packs (four-sided) IC's.

Soldering, Desoldering and Wire-Wrap Tools are allowed on Open General Licence per current import policy. Custom duty is levied @ 20 percent ad valorem.

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KAVERI

Some Appreciations

I have just started taking interest in making electronic projects and gadgets. EFY has attracted my attention to the world of electronics. I have constructed some easy-to-make projects on my own.

Convey my thanks to Mr A. Subrahmanyam for the article on 'Troublesome Tubelight'. It is working very well.

SUNIL G. KRIPLANI
Bombay

□ The article on 'Quick 741 and IC555 Tester' by Mr Anupam Saurabh which was published in the issue of March was found very interesting. I think you should publish more articles like this.

A. RAGHUNATHAN
Karaikudi

Available: PCB Factory and 2-way VHF/UHF Equipment

We wish to enquire whether you could, through your good office, locate suitable parties who are interested in: (1) VHF/UHF FM 2-way radiotelephone, repeater, telemetry etc, and (2) single-sided PCB factory.

MPE Electronics currently manufacture 2-way VHF/UHF radio and are looking for possible venture to sell these merchandise to the Indian market.

We also have a subsidiary, producing single-sided PCBs. We are looking forward to sell the whole factory with semi-auto line, capacity: 5000 to 8000 sq. m per month, 26 days, 8 hours per day.

J.C. LIM
General Manager
MPE Electronics Pte Ltd
45 Kallang Pudding Road
# 07-04 Alpha Building
Singapore 1334

Guide to BASIC

Continuing from my article in the January issue of EFY entitled 'A Simplified Guide to Computer Programming in BASIC' I've written a fairly simple program to illustrate some of the points that were raised. Your readers should quite easily (!!??) be able to follow the listing below which is for the BBC Micro/Acorn Electron.

The program is entitled 'Yes Mr President', and with certain changes works on the Apple, TRS-80, ZX-Spectrum, VIC and PET computers.

You are the President of a small island and your aim is to survive for 10 years in office. You are financed by gold mines, each worth £100, which are available to you to sell at any time to raise capital. You are responsible for feeding and educating your people. If you do not feed or educate them then they are likely to depose you!

Beware... every now-and-again your island is invaded by mosquitos which eat the main crop of your land and thus cause hardship and death to your people; you are required to help them with finance. If your people are

```
10 CLS
20LET G=INT(RND(1)*8+1)
30LET C=INT(RND(1)*200+100)
40LET P=INT(C/10+INT(RND(1)*[illegible]))
50LET M=0
60 LET Y=1
70 LET S=1
80 PRINT
90 LET M=P*100+INT(RND(1)*1500+1)+M
100PRINT"YOU HAVE ";G;" GOLD MINES EACH WORTH £100 AND "
110 PRINT"THERE ARE ";P;" PEOPLE ON YOUR ISLAND AND YOU HAVE £";M
120PRINT
130PRINT"HOW MANY GOLD MINES WOULD YOU [illegible]"
140 INPUT A
150 IF A G THEN GOTO 1100
160LET G=G-A
1[illegible]
180 PRINT"YOU NOW HAVE £";M;" BECAUSE YOU SOLD ";A;" MINES."
190 PRINT"LEAVING YOURSELF WITH ";G;" GOLD MINES "
200 PRINT
210 PRINT"HOW MUCH WOULD YOU LIKE TO SPEND ON FOOD"
220 PRINT"  THE MINIMUM AMOUNT RECOMMENDED IS [illegible] £[illegible]"
[illegible] INPUT B
240 IF B M THEN GOTO 1120
250LET M M B
260IF P*110 B AND B 100*P THEN LET [illegible]
270IF B 111*P THEN LET S 1+0.
280IF B 99*P THEN LET S 1 0.
290 PRINT
300PRINT"HOW MUCH MONEY WOULD YOU LIKE TO [illegible]"
310 PRINT" - MINIMUM RECOMMENDED IS £10 PER PERSON"
320INPUT D
330IF D M THEN GOTO 4[illegible]
340IF D M AND [illegible]"
350 PRINT"  WOULD YOU LIKE TO SELL [illegible]"
360INPUT I$
370 IF I$="N" THEN GOTO [illegible]
380 PRINT"HOW MANY WOULD YOU [illegible]"
390 INPUT F
400 IF F G THEN GOTO 2[illegible]
410LET M=M+F*100
420LET G=G-F
430GOTO 300
440LET M=M D
450IF D 5*P THEN LET S S [illegible]
460IF D 6*P AND D 9.9*P THEN LET S S [illegible]
470IF D [illegible] THEN LET [illegible]
480 PRINT
490PRINT"YOU HAVE ";G;" GOLD MINES AND [illegible]"
500 PRINT"ON YOUR ISLAND AND YOU HAVE £";M
510 PRINT
520PRINT"IT IS NOW THE HARVEST SEASON AND YOU HAVE ";C;" ACRES OF CORN"
530IF (RND*10) [illegible] THEN GOTO [illegible]
540 GOTO 770
550LET X=(RND(1)*0.9+0.5)
560 LET C=INT(X*C)
570 LET N=INT(P*(1 X))
580 PRINT"MOSQUITOS HAVE EATEN A LARGE AMOUNT OF CORN."
590 PRINT"YOU NOW HAVE ONLY ";C;" ACRES."
600 PRINT"ONE ACRE WILL USUALLY FEED 10 PEOPLE"
610 PRINT" BUT NOW ";N;" WILL DIE "
620 PRINT"YOU CAN HELP [illegible] £20 [illegible] TO THEM [illegible] WILL DIE.
630 PRINT"DO YOU WISH TO HELP "
640INPUT A$
650IF A$="Y" THEN GOTO [illegible]
660 LET S=S-0.2
670 LET P=P N
680 GOTO 770
690PRINT"HOW [illegible] IN MULTIPLES OF £20
700 INPUT F
710IF F M THEN GOTO 690
720LET M M F
730LET L=F/20
740PRINT"YOU HAVE SAVED ";L;" PEOPLE"
750LET S=S+0.2
760LET P P N+
770PRINT"THERE ARE ";P;" PEOPLE ON THE ISLAND"
780 PRINT"AND YOU HAVE  ";M" AND ";G;" GOLD MINES"
```

```
[illegible]

Changes for different computers:

If you have an Apple then change line 10 to Home

If you have a VIC or PET then change line 10 to PRINT CHR$(147)

For lines 20 30 40 90 530 and 550,if you have a TRS 80 then change
RND(1) to RND(0)

For lines 20 30 40 90 530 and 550,if you have a ZX-Spectrum then
change RND(1) to RND
```

satisfied with your performance then each year you will be rewarded with £1500 with which you can buy gold mines for a mere £25 and then resell them for £100 How's that for solving the world's problems!

See if you can survive 10 years in office. Try to expand the program to accommodate more random and unforeseen events (like the mosquitos) Since this program is designed to work on a number of computers, the PRINT statements may be too long for some of them. You can shorten them to suit your machine Good Luck!

P. SHARMA
Middlesex, UK

SWL Using Domestic Receiver

It is really a great experience to be able to tune to the ham bands with a domestic receiver I copied a lot of SSB (single side-band) amateur stations during the past few days using my National Panasonic 3-band domestic receiver (with cassette recorder) by providing the necessary injection voltage from the local oscillator of a 2-band pocket receiver set (Paman-batsman) I just tune this receiver to heterodyne with the ham band frequency and successfully use it as a beat frequency oscillator (BFO)

Coupling to the detector stage of the main receiver is done only by keeping it near the receiver. The BFO unit works very efficiently on the strong SSB signals but the weak SSB signals are somewhat suppressed For readers' information, I am giving some details about what I have monitored during the past few days I hope the hams who have been logging the activities will find my information correct!

The first OM I copied on February 7 at about 2339 IST was 'Bebu' from the QTH Belgaum with a call sign VU2PNU I heard him with a QSA report of 5 and 7 here when he was calling a CQ He was using a ICOM IC 751 shack with a simple dipole antenna He was responded by VU2BSB from New Delhi whose handle was 'Balwant' VU2PNU talked to VU2BSB and 'Raj' from Bangalore and the signal reports given by him to both of them respectively were 53 and 59

At about 0002 IST, VU2PNU asked VU2KOC to go ahead. VU2KOC welcomed VU2PNU, VU2BSB and VU2RSD at the same time from the QTH Belgaum (same as Bebu) and told Balwant that it was already morning, so he wished him a very good morning and told him that he was coming very fantastic. VU2KOC gave the signal report as 57 to 58 to VU2BSB and wondered how Bebu was not copying VU2BSB as him So he thought the reports to be critical for VU2BSB. VU2KOC introduced himself to VU2BSB as Omprakash. At about 0008 IST, VU2PNU explained the fact why both of them (VU2PNU and VU2KOC) from the same QTH received VU2BSB from New Delhi with a different signal report. According to him, both their antennae were simple dipoles, but his antenna direction was East-West while the antenna direction of VU2KOC was South-North; so VU2KOC was copying VU2BSB fantastic!

On February 8, I monitored the QSO between VU2HSM and UB4CWW at about 2049 IST until 2052 IST. VU2HSM was coming very loud and clear from Alleppey, South India near the Arabian Sea (as he told the Russian ham), and his name was Moni (handle) while the handle of the Russian station was 'Yuri'.

On February 9 at about 2252 IST, I copied the QSO between VU2KYX and 3B8FP. Handle of 3B8FP I heard was 'Rasid' (he perhaps came from Mauritius Islands!) VU2KYX was talking to VU2GXX and 3B8FP at the same time and was sorry to keep Rasid waiting as he was transmitting the second half of his message.

Let me mention that I copied all those amateur stations in the 20-metre ham band and yet on February 11, it was my good luck that I copied a Dutch amateur radio operator—one Mr Robbert—who was travelling on a cargo ship in the Indian Ocean There was a nice QSO going on between Robbert and VU2KYX I couldn't copy VU2KYX (whom I copied on Feb. 9) but Robbert was coming to me very well I heard him at 1718 UTC (2248 IST). His QTH was about 700 miles west from Bombay and the exact position he gave to VU2KYX after he looked at a display in the radio room was 17.42 North and 64.08 East at about 1723 UTC. Robbert was bound for Iran I could not copy Robbert's call sign but it was somewhat like PA3DA or PA3DKL followed by the words 'Maritime Mobile'. (I would be very glad if somebody give me his exact 'callsign'!) Robbert talked to VU2KYX on different subjects and I really enjoyed him He was a very jolly person. He talked about IBM and Apple computers, about his native country—the Netherlands. He told VU2KYX that he lives in the centre of the Netherlands, in a place called 'Culemborg'

At about 1840 UTC, Robbert was called by VU2YU and the QSO lasted only for five minutes. Robbert told VU2YU that he met five to six hams from Bangalore and that he copied VU2YU with a report of 59 and with good modulation. He told VU2KYX that they had a satellite communication system in their cargo ship which was out of order since January 14. Robbert ceased his transmission at about 1845 UTC.

On February 13 at about 0230 UTC, I monitored the QSO between AP2MQ (handle: Mansur, QTH: Lahore) and JA5AUC. AP2MQ was also talking to JA3OCD, VS6HF.

I have been doing DXing in the last four or five months on the broadcast bands only. I came to the exciting world of ham bands with the same domestic receiver with a 6-metre long omnidirectional simple vertical antenna. This is a great achievement for me; and the credit goes to 'EFY' solely!

SANDEEP BARUAH
Suwonee Path, Lachit Nagar,
Guwahati 781007 (Assam)

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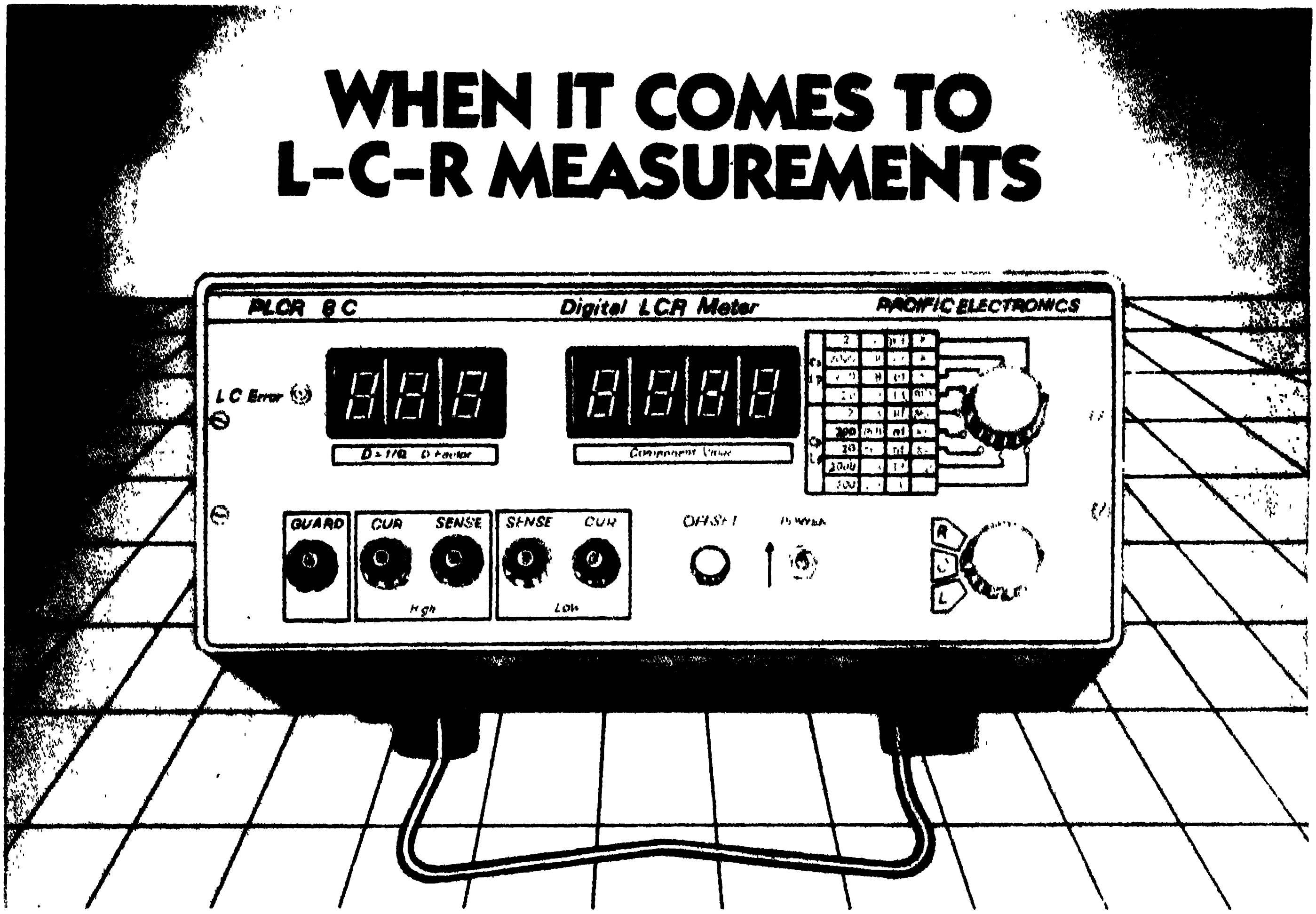

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RSA/TM/16/85

IN INDIA....

Electronic items de-reserved

The government has announced the dereservation of 14 items from the small-scale sector. These include four electronic items, viz, TV deflection components, electronic cigarette lighters, electronic flashguns and hearing aids.

Besides, in the case of 18 items, including TV tuners, the nomenclature has been changed keeping in view the changed conditions and requirements of the industry. The existing nomenclature 'TV tuners' has been changed to 'TV tuners excluding electronic tuners'. This would mean that while turret tuner continues to be in the small-scale, electronic tuner is out of it.

Elcina's awards for excellence

The Elcina awards for 1985 for excellence in research and development, import substitution, exports of electronic goods and indigenous development of capital goods were recently presented by Mr Abid Hussain, member, Planning Commission.

Central Electronics Engineering Research Institute (CEERI), Pilani, and Satwik Electric Controls Pvt Ltd, Nasik were adjudged joint winners of the award for research and development for their pioneering work in electronic instrumentation for sugar industry with R&D support provided by the Department of Electronics (DoE) under the Technology Development Council Programme.

The second prize for R&D went to Continental Device India Ltd (CDIL), New Delhi, for its significant contribution in R&D for improving the existing processes for semiconductor devices which have certain limitations for high reliability applications. These are: front metal process which overcomes the problems associated with aluminium, and tin plated metal-can transistors which overcome the problems associated with gold-plated parts.

A special certificate of merit was awarded jointly to Bharat Heavy Electricals Ltd (BHEL), Bangalore, and the University of Pune (Physics Department) for their noteworthy R&D contribution to enhance the manufacturing yields of power semiconductor devices by perfecting the control of some of their dynamic characteristics using electron irradiation—a good example of successful cooperation between industry and an academic institution in a frontier area of technology.

The award for import substitution was given to Rao Insulating Co. Pvt Ltd, Bangalore, for its sophisticated PCB facility for use in the manufacture of colour TV receivers. Hindustan Enterprises, Allahabad, received a special certificate of merit for its efforts in import substitution by manufacturing different types of electromechanical components and connectors of a wide variety for different applications, which have been type-approved and field-tested.

Sujata Data Products Pvt Ltd, Secunderabad excelled in export of electronic goods showing a remarkable export performance by exporting 45 per cent of its total production in 1985 totalling Rs 24.4 million.

Morris Electronics Limited, Pune was chosen for excellence in the indigenous development of capital goods by indigenising two major equipment used in the manufacture of hard and soft ferrites, namely, a high volume rotary calciner and an air-fired sintering furnace, resulting in significant savings of foreign exchange. This has led to upgradation of local capabilities for the development of this industry.

Second ILT digital exchange commissioned

India's second Integrated Local-cum-Trunk (ILT) digital exchange was commissioned recently at Hebbagodi, a rural industrial area near Bangalore. This is the first exchange of its type to be connected to the communications network in Karnataka. The first exchange has been installed at Udayamperoor near Ernakulam in Kerala.

The 512-line exchange, which has been jointly developed by the Indian Telephone Industries (ITI) and the Telecommunications Research Centre of the Department of Telecommunications (DoT), will help the subscribers of Hebbagodi to get quick access to the telecommunication network of the city of Bangalore, which hitherto was not possible.

The ILT is specially designed to economically serve the low capacity rural exchanges and brings the subscribers to the national and STD network. Some other highlights of this exchange which are not available in other exchanges are: call alert, call waiting hotline, malicious call trace, group hunt, and facility of ring-back when free.

Large-scale manufacture of this equipment has been undertaken at ITI's Palghat unit and a number of such exchanges will be in operation in the country's rural network in the near future.

I&B Ministry to monitor TV/AIR Projects

To ensure speedy implementation of the government policy to expand the radio and TV network, the Ministry of Information and Broadcasting will monitor the progress of the schemes every month.

This was decided at the fourth annual Conference of the Officers of the Civil Construction Wing (CCW) of AIR which met recently.

The conference was held to discuss the action plans of various civil and electrical works of AIR Doordarshan and other media units of the Ministry of I&B, so as to achieve the targets assigned for the Seventh Five-year Plan.

Public data network commissioned

The first packet-switched experimental data network was recently commissioned by the communications minister, Mr Ram Niwas Mirdha The versatile network offers a range of facilities to its subscribers, including transmission of videotex, facsimile and other telematic services. It will permit message transfer, interactive access to a distant computer and computer to computer communications.

Set up jointly by the Telecom Research Centre and TCIL, packet switching is a state-of-the-art technique for public data networks. It enables data communications on a real-time basis. In the initial trial stages, the service will be offered to a limited number of subscribers in Delhi, Bombay and Madras, free of charge, to enable the Department of Telecommunications to collect data on the type, pattern and volume of traffic, and also get feedback from the subscribers regarding any improvements or changes for greater utility of the service

The network will provide a new service of electronic mail box. In this facility, a message sent across the network can be retrieved by the addressee at his convenience. Privacy will be ensured as the message would be available only after a code check

Access to the network would be possible in several different ways. One would be a direct one to any one node on the line. Phone subscribers will have access through the public-switched telephone network. The system can also be used through the telex machine.

The entire data communication software for this service has been developed by TCIL. This includes switching software, packet assembler and disassembler (PAD) software, electronic mail-box software, network management centre software which includes network configuration and control, network status monitoring, statistical and accounting data collection, accounting and traffic analysis and telex interference.

Based on the results of this experiment a bigger network is proposed within the next two years with eight nodes at Bombay, Delhi, Calcutta, Madras, Bangalore, Hyderabad, Pune and Ahmedabad. These nodes will link 20 cities all over the country, providing a widespread public data network which will also provide international access

Telecom production touches a new high

The four telecommunication factories located at Bombay, Calcutta, Jabalpur and Bhilai achieved production worth Rs 334 million during the year 1984-85 as compared to Rs 324.2 million during the previous year. This is the highest production achieved so far. The factories achieved production aggregating Rs 242.9 million up to December 1985 against the annual target of Rs 394 million

These factories manufacture a variety of equipments like manual trunk and local exchanges, PBX boards, coin box telephones, switchboard cords, DP boxes, CT boxes, line stores, telegraph equipment, microwave towers (steel lattice type) etc used as inputs for development and operation of telecommunication services.

The organisation has embarked upon an ambitious modernisation programme which includes (i) setting up of modern galvanising plants at Calcutta and Jabalpur, (ii) setting up of a modern integrated tube making plant at Jabalpur, (iii) manufacture of modern cable termination boxes at Calcutta; and (iv) setting up of a modern mechanised foundry at Kharagpur in West Bengal.

A contract was finalised with a West German firm Krone for the supply of plant and machinery and transfer of knowhow for the manufacture of modern cable termination boxes in the telecom factory at Calcutta. The staff has been trained in West Germany for the purpose.

India's ambitious space programme

India proposes to launch three specific purpose satellites a year during the next decade. This ambitious scheme is most likely to begin during August-September this year with the launching of the five-stage augmented satellite launch vehicle (ASLV) carrying a payload of 150 kg.

According to Dr Suresh Chandra Gupta, director, Vikram Sarabhai Space Centre (VSSC) at Thumba near Trivandrum, these satellites will be used exclusively for communications, remote sensing and back-ups. The Indian industry—both in the public and private sector—will be involved in this venture in order to make the country totally self-reliant.

The industry's opportunities lie in areas like mechanical fabrication, development of newer propellant formulations, polymers, special chemicals and electronics. The industry has already fabricated components for the first three stages of a launch vehicle while VSSC in-house research techniques are used for the final two stages.

According to Indian Space Research Organiation's (ISRO) plans, two ASLVs and two polar satellite launch vehicles (PSLVs) should be in orbit by the turn of the present decade. Instead of the present optical and near infra-red images, the future satellites will have microwave facilities.

India to make earth stations soon

India will manufacture for the first time low-cost earth stations with US collaboration. The US government has given the green signal to the Equitorial Inc., the only company in the world which has this technology, to go ahead with the collaboration arrangements. The Indian Telephone Industries (ITI), a public sector undertaking under the Department of Telecommunications, will be the Indian partner. An agreement is expected to be signed soon.

Under the agreement, the Equitorial Inc. has agreed to transfer knowhow for the manufacture of the earth stations. What is more, the two companies will manufacture these stations for exports.

The technology transfer is expected to be in a phased manner. Initially, 127 stations would be imported in CKD and assembled here to meet the immediate needs of the National Informatics Centre

Major Duty Reliefs to Electronics Industry

The Ministry of Finance recently announced a series of post-budget concessions to trade and industry which will cost the exchequer a loss of Rs 1000 million per year. A major share of the reliefs—to the extent of Rs 600 million—has gone to the electronics industry, where the customs duties have been drastically reduced.

The Ministry of Finance has evolved a customs tariff structure relating to raw materials, piece parts and components for the electronics industry in consultation with the Department of Electronics.

Raw materials and piece parts will now carry customs duty of 30 per cent and 45 per cent *ad valorem* respectively.

Capital goods for modernisation of the electronics industry will carry a concessional duty of 55 per cent *ad valorem*. Moulds, tools and dies for the electronics industry will also attract 55 per cent *ad valorem*.

The general rate of duty of customs on computers is being reduced from 200 per cent to 150 per cent *ad valorem*.

Components by way of spares of computer peripherals will now attract 75 per cent *ad valorem*.

On the excise side, the special scheme for radios and transistor sets of value not exceeding Rs 165 per set is being withdrawn. These goods have already been included in the general small-scale exemption scheme.

These concessions are a result of the discussions between the finance minister and representatives of trade and industry in open-house meetings held from time to time. These reliefs are expected to give a boost to the indigenous industry and also encourage competition.

(NIC). NIC proposes to instal about 400 such stations in the rural areas to connect them with the rest of the country and the computer network through satellite. The cost of each station will be Rs 75,000.

It is for the first time that the US company has agreed to transfer the know-how for which it enjoys a monopoly throughout the world. It is the only company which specialises in the spread spectrum technology that enables linking of at least 2000 terminals on to the satellite through the earth station. These terminals can be placed on the satellite together. Thus it offers a wider coverage of computer linkages.

Keltron's new chairman

Mr Thomas Kora took over as the chairman of the Kerala State Electronics Development Corporation (Keltron) on June 14, 1986. Besides his present assignment, Mr Kora is also the commissioner for Electronics Development in Kerala.

Mr Kora succeeds the first chairman of Keltron, Mr K.P.P. Nambiar, who resigned in February 1985 to take over as the chairman of the Indian Telephone Industries, Bangalore. For over one year, Keltron has been more or less headless although Mr P.G. Muralidharan, Industrial Development commissioner, was acting as the corporation's chairman.

CLIK executive committee

The Consortium of Electronics Industries (Karnataka) selected its new executive committee for the year 1986 at an annual general meeting held recently.

Mr B.J. Shreedhara was elected president in place of Mr Surendra P. Kamath who is the outgoing president. Mr H.S. Nagaraj was chosen as the vice-president. Other selected members were Mr B.T. Tukol (honorary general secretary), Mr S. Jayaram (joint secretary) and Mr R. Vardarajan (treasurer).

AREA plea to RBI

The All India Radio & Electronics Association recently had discussions with the sub-committee for Electronics appointed by the governor of the Reserve Bank of India regarding the availability of finance to the electronics trade and industry.

Since the volume of trade in electronics is expected to reach a target of Rs 108 billion, an effective and positive marketing back-up is a necessary corollary. The association has exhorted the RBI to extend financial assistance to electronics traders through various banks, and their requirements considered on a priority basis.

....AND ABROAD

USSR news through British technology

A British firm, Datasolve, is to be the first to distribute political and economic news from TASS, the Soviet news agency, by electronic means to anyone with a microcomputer. Anyone in the world with a desk-top computer or word-processor connected to a telephone line will be able to gain access to TASS's 40,000-word English language newswire, which will be added daily to the database held on Datasolve's computers at Sunbury, west of London. Seventy stories and a 1000-word economic news bulletin will make up the daily TASS material. Earlier TASS stories will also be stored.

The TASS output will be part of World Reporter, the UK's largest full-text international news and current affairs service, offering over 350 million words at any one time and used in 30 countries.

Developed jointly by Datasolve and the BBC, World Reporter uses sources that already include newspapers like *The Guardian* and *Financial Times* (Britain) and . *Washington Post* (United States); Britain's *New Scientist* and *Economist* magazines; the 'Asahi' (Japan) and 'Associated Press' (United States) news services; and the BBC summary of world broadcasts and external services news.

A subscriber uses six simple keyboard commands to make an inquiry of World Reporter. In seconds the service searches out all items that may be relevant and indicates their headlines and length. If too many are found, further search words can be entered to refine the selection. All wanted items can be read on the computer screen or hard-copied on a linked printer for later study. Overseas subscribers can gain access to World Reporter through the worldwide IPSS data communications network, which is much cheaper than an international telephone call.

Taiwan electronics show

The 12th Taiwan International Electronics Show organised by the China External Trade Development Council will be held at Taipei between October 7-13 this year. The show will be held at the new exhibition hall of the Taipei World Trade Center who is also sponsoring the show.

More than 900 companies from Taiwan and abroad are expected to participate. Countries taking part in the show include the USA, West Germany, Canada, Japan, Hong Kong, India and Singapore. The main exhibits at the show include computers and peripherals, industrial and domestic products, telecommunications equipment, parts and components.

Companies wishing to participate at the Taiwan Electronics Show may contact the China External Trade Development Council at the Taipei World Trade Center Exhibition Hall, 5 Hsinyi Road, Sec. 5, Taipei 10509, Taiwan, Republic of China before September 7.

Information system Interkama

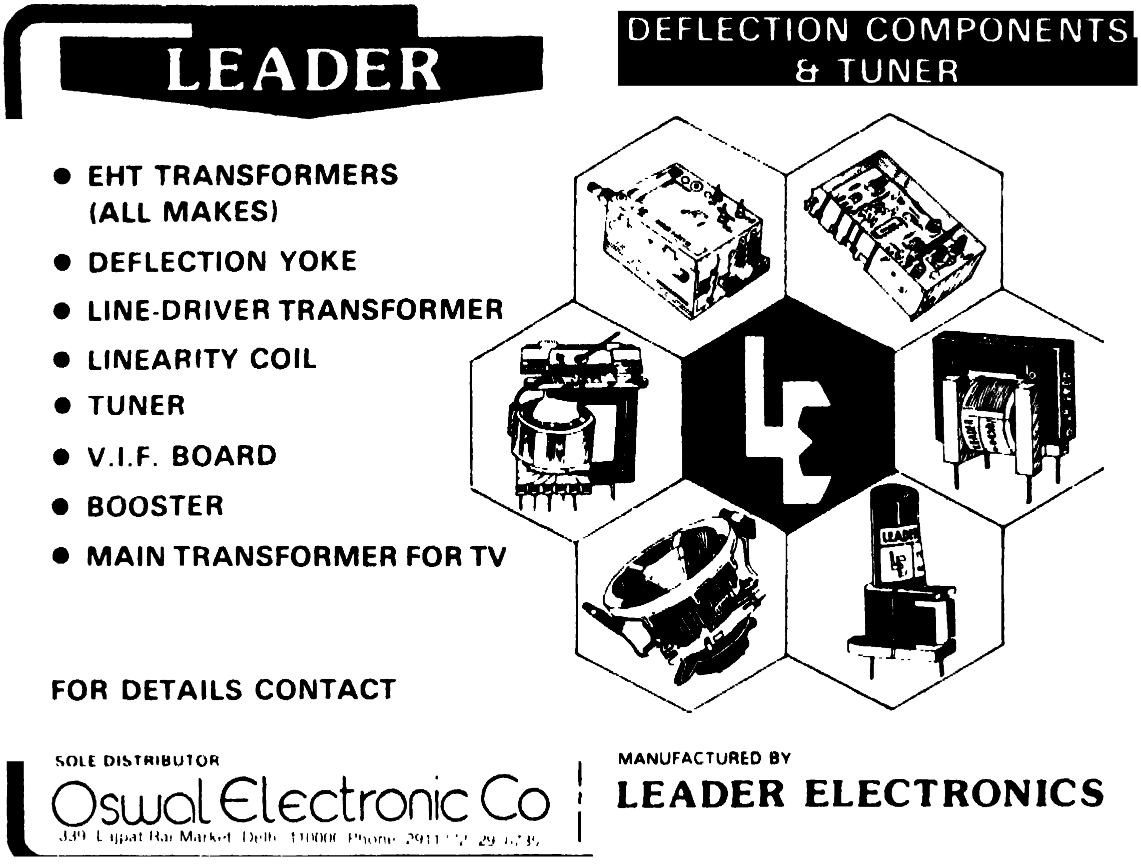
The Interkama is considered to be the world's first self-service fair information system providing information on a wide variety of subjects in a conversational mode.

First featured at the German Interkama fair in 1977, the system has been continuously updated. The latest system, the Interkama ISI, is based on Kabeltext, the leading information system in terms of efficiency and user friendliness.

For Interkama 86, the 10th International Congress with Exhibition for Instrumentation and Automation to be held at Dusseldorf between October 6-11, the number of terminals supplying information has been increased from 30 to 45. This increase is intended to reduce waiting time. A swifter printout of "how to get there" instructions and a reduction in printing time will allow more frequent use of the system and faster dialogue.

The information facilities available from ISI have been extended by including an electronic meeting point. This allows visitors the possibility of leaving a note for persons they wish to talk to or have someone located and requested to turn up at a specific meeting point. This information can then be called up at all the ISI terminals.

The list of exhibits which can be interrogated in the ISI system has been extended to include synonyms. It now contains more than 3000 entries, providing visitors with a printout of a plan showing how to get to the product and containing details on the exhibitors of the product.



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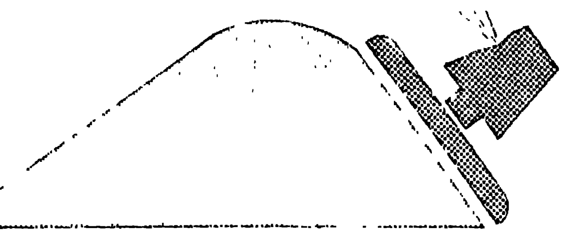

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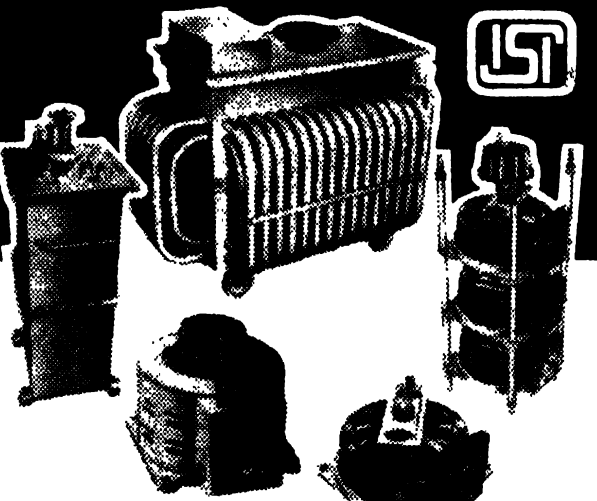

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Amateur Radio Regulations

Ashok Baijal VU2AEY

Amateur Radio is an exciting hobby. Hams or amateur radio operators are a group of people with common yet varying interests, who exchange ideas with 'on-the-air' contacts. You can be friends with a Japanese businessman, a US senator or a head of state without leaving the confines of your home.

Origin

Amateur radio was first started at the turn of this century. At that time there were no government regulations and 'amateur' experimenters started duplicating Marconi's inventions to communicate with each other 'on-the-air'. Soon the governments intervened and the amateurs were pushed to bands of 200 meters and below, then considered useless. However, it was discovered by hams that these frequencies permitted long distance communication. The beginning of World War I put an end to amateur radio operations and it was not until October 1, 1919 that the governments again permitted hams to transmit.

Amateurs have contributed a lot to the development of on-the-air communications. Their ideas have been absorbed by the industry with surprising results. The pre-war technical progress made by amateurs has provided the nucleus for development of modern military communication equipment, the single sideband (SSB) technique being one. Amateurs have even built their own communication satellites.

Indian regulations

The government of India has formulated 'the Indian Wireless Telegraphs (Amateur Service) Rules 1978' in terms of Sections 4 and 7 of the Indian Telegraphs Act 1885.

Amateur service has been defined as a service of (i) self training; (ii) intercommunication: and (iii) technical investigations in radio techniques carried out by persons (a) duly authorised, and (b) interested in radio techniques.

The service must be carried on (i) only with a personal aim, and (ii) without any pecuniary interest.

Types of messages

Messages of one station can be exchanged only with other duly authorised amateur stations. However, the amateurs are not allowed to communicate with amateur stations of countries whose administrations have notified to the International Telecommunication Union (ITU) of their objection to such radio communications.

Transmissions must be made in a plain language and limited to messages of a technical nature relating to tests, remarks of a personal character or a transaction in which both hams are directly concerned and for which by reason of their unimportance recourse to the public telecommunication service is not justified. However, the licensee is forbidden to transmit messages like the reproduction of broadcast programmes, tape recordings, transmissions of entertainment value or music. Also, false or misleading calls, news, advertisements, communications of business, statements on topics of political/industrial controversies, any matter which is indecent, obscene, seditious, offensive and likely to arouse racial, religious or communal animosity or messages for or on behalf of third parties are forbidden.

However, in case of failure of normal telecommunication facilities, amateurs are permitted to handle third party messages pertaining to natural calamities such as earthquakes, floods, cyclones and widespread fires. These messages should emanate from and addressed to a competent civil authority.

Licence

In order to establish, maintain and work an amateur wireless telegraph station, it is essential to hold a licence issued under Section 4 of the Indian Telegraphs Act 1885.

There are five categories of licences, namely:

1. Advanced Amateur Wireless Telegraph Station Licence.
2. Amateur Wireless Telegraph Station Licence Grade I.
3. Amateur Wireless Telegraph Station Licence Grade II.
4. Restricted Amateur Wireless Telegraph Station Licence.
5. Short-wave Listeners' Amateur Wireless Telegraph Station Licence.

Eligibility

A licence may be granted to a person who fulfils the following criteria:

1. He is a citizen of India.
2. He is not less than 12 years of age if he desires a Restricted Grade or Grade II licence, or has completed 14 years of age for Grade I licence, or 18 years of age for Advanced Grade Licence.
3. He should be a holder of a certificate or should qualify the examination specified below:
   - (i) A Radio Communication Operators' General Certificate; or
   - (ii) A first or second class Radio Telegraph Operators'

Certificate; or

(iii) The relevant Amateur Station Operators' Examination.

Box I

APPLICATION FROM AN INDIVIDUAL FOR A LICENCE TO ESTABLISH, MAINTAIN AND WORK AN AMATEUR WIRELESS TELEGRAPH STATION IN INDIA

[See Rules 6 and 8]

(Last name) (First) (Middle)

2 Father's name and address

3 Address (Present)

4 Address (Permanent)

5 Date of birth Place of birth Nationality Occupation

6 (a) Category of licence applied for (b) Exact location of the Station

7 Do you hold Radiotelegraph Operator's Certificate? If yes, give particular

Name of the certificate No Date of issue

8 Particulars of Amateur Station Operator's Examination

Name Centre Month of Examination

9 Particulars of apparatus to be used

Apparatus	Manufacturer's Name	Type No	Frequency Range	R F Power Output
Transmitter				
Receiver				
Frequency measuring device				

10 If appeared in any of the Amateur Station Operator's Examination Yes No
If yes indicate the date of the examination

DECLARATION

I hereby, solemnly declare that the foregoing facts are true and correct and nothing is false therein and nothing material has been concealed therefrom. I also agree that in case any information given by me hereinbefore is found false at a later date, the licence, if granted, will be cancelled

I further solemnly give an undertaking that I will not either directly or indire divulge to any person, except when lawfully authorised or directed to do so, the purpor essage which I may transmit or receive by means of any wireless appar d by me or which may come to my knowledge in connection with the operatio d apparatus

I h e carefully read and understood the rules contained in the Indian Wirel Teleg aphs (Amateur Service) Rules, 1978 and undertake to abide by them and obs nditions of the li The licensed station shall not be made accessible to any thorised person at any time

Sig ture of witness	*Signature of applicant*
Na (in block letters)	Name (in block letters)
Add	Date
Dat	Place

Note- 1 An attested copy of birth certificate or school leaving certificate must be accompanied along with the application
2 Enclose a certificate in support of nationality in the prescribed proforma, indicated in Box III from one of the officers listed therein

The amateur station operators' examination

The amateur station operators' examination is conducted by the Ministry of Communications at the following places:

1. Delhi Bombay, Calcutta and Madras—every month.
2. Ahmedabad, Hyderabad and Nagpur—January, March, June, August, October and December.
3. Ajmer, Bangalore, Darjeeling, Gorakhpur, Jullundar, Goa, Mangalore, Shillong, Ranchi, Srinagar and such other places where a monitoring station of the Monitoring Organisation of the Ministry of Communications is located—January, April, July and October.

An application on the prescribed format (Box I) has to be submitted to the examination centre not later than the 15th of the month preceding that in which it is desired to take the examination. The application form must be accompanied by a draft drawn in favour of the "Pay and Accounts Officer, (Secretariat) Ministry of Communications, New Delhi" payable at the State Bank of India, Main Branch, Parliament Street, New Delhi on the following scales:

(i) Advanced Amateur Station Operators' Examination	Rs 25.00
(ii) Amateur Station Operators' Grade I Examination	Rs 20.00
(iii) Amateur Station Operators' Grade II and Restricted Grade Examination	Rs 10.00

The examination consists of a written paper and a practical on morse sending and receiving. The written paper consists of two sections—one on radio theory and practice and the second on national and international regulations applicable to the operation of an amateur station.

In case of Restricted Grade and Grade II examinations, the written paper is of one hour duration. The candidate must secure at least 40 per cent marks in each section and 50 per cent in aggregate for a pass. While candidates for Restricted Grade are exempted from morse sending and receiving; candidates for Grade II must be able to send and receive a test piece of plain language at a speed of five words per minute. For Grade I examination, the written test is of two hours' duration. Further, the candidate is required to receive a test piece of 300 characters including letters, figures and punctuations sent in morse at a speed of 12 words per minute. A similar passage has also to be sent at the same speed. For the Advanced Grade examination, the written paper is of three hours' duration.

The detailed syllabus for the Grade I and Grade II examinations is given in Box II.

Frequencies, emissions and power

Radio amateurs are allocated frequency bands, power and types of emission by the central government. The allocation is done keeping in view, among other things, the provisions of the ITU convention and the need for enforcement of better technical standards in respect of equipment and natural and international radio interference patterns. The present allocations are given in Box III.

Box II

Detailed Syllabus of Amateur Station Operators' Examination

SECTION I: Radio Theory and Practice

Elementary electricity and magnetism:
Elementary theory of electricity, conductors and insulators, units, ohms law, resistance in series and parallel, conductance, power and energy, permanent magnets and electromagnets and their use in radio work; self and mutual inductance; types of inductors used in receiving and transmitting circuits, capacitance; construction of various types of capacitors and their arrangements in series and/or parallel.

Elementary theory of alternating currents:
Sinusoidal alternating quantities—peak, instantaneous, RMS average values, phase; reactance, impedance series and parallel circuits containing resistance, inductance, capacitance; power factor, resonance in series and parallel circuits; coupled circuits; transformers for audio and radio frequencies.

Thermionic valves:
Construction of valves; thermionic emission, characteristic curves, diodes, triodes and multi electrode valves; use of valves as rectifiers, oscillators, amplifiers, detectors and frequency chargers, power packs, stabilisation and smoothing, elementary theory and construction of semiconductor devices—diodes and transistors.

Radio receivers:
Principles and operation of TRF and superhetrodyne receivers, CW reception; receiver characteristics—sensitivity, selectivity, fidelity; adjacent channel and image interference; AVC and squelch/circuits; signal to noise ratio.

Transmitter:
Principles and operation of low power transmitter; crystal oscillators, stability of oscillators.

Radio propagation:
Wave length, frequency, nature and propagation of radio waves; ground and skywaves; skip distance; fading.

Aerials:
Common types of transmitting and receiving aerials.

Frequency measurement:
Measurement of frequency and use of simple frequency meters.

SECTION II:—Regulations

(a) Knowledge of
  (i) The Indian Wireless Telegraph Rules 1973;
  (ii) The Indian Wireless Telegraph (Amateur Service) Rules 1978.
(b) Knowledge of International Radio Regulations as relating to the operation of amateur stations with particular emphasis on the following:

Item	*Provision of Radio Regulation*
Designation of Emission	104-110
Nomenclature of the frequency and wavelength	112
Frequency Allocations to Amateur Services	Article 5
Measures against interference	667-677
Interference and Tests	693-703
Identification of Stations	735-737, 743, 772-773
Distress and Urgency Transmissions	1389-1396, 1477-1478, 1481, 1483
Amateur Station	1560-1567
Phonetic alphabets and figure code	Appendix 16

(c) Standard frequency and time signals services in the world.
(d) The following 'Q' codes and abbreviations which shall have the same meaning as assigned to them in the convention: QRA, QRG, QRH, QRI, QRK, QRL, QRM, QRN, QRQ, QRS, QRT, QRU, QRV, QRW, QRX, QRZ, QSA, QSB, QSL, QSO, QSU, QSV, QSW, QSX, QSY, QSZ, QTC, QTH, QTR and QUM.
AA, AB, $\overline{AR}$, $\overline{AS}$, C, CFM, CL, CQ, DE, K, NIL, OK, R, TU, $\overline{VA}$, WA, WB.

Importing equipment

Every ham requires a communication receiver, a transmitter and a suitable antenna for operation. A communication receiver is similar to an ordinary broadcast receiver but has high sensitivity and selectivity since it has to receive very weak signals on overcrowded frequency bands. The transmitter must have high frequency stability and negligible spurious radiation.

Till a few years back, the Indian ham had to build his own equipment as its import was not allowed. However, he was greatly assisted in his effort by the availability of large quantities of World War II surplus equipment in the junk market. But now these supplies have dried out.

The government of India in its effort to promote this hobby permitted the import of amateur equipment by including it under the open general licence (OGL). However, since these items were subject to heavy customs duty only a few hams were able to take full advantage.

At the request of the Amateur Radio Society of India, the central government vide notification no. 78/84 and 79/84 customs dated March 9, 1984 exempted wireless apparatus, accessories and components specified in the notification from the levy of customs duty subject to a CIF value of Rs 10,000 when imported by a licensed amateur radio operator. The facility was initially available up to March 31, 1985. The last date was subsequently changed to December 31, 1985, but since a number of amateurs were not able to avail this facility, the Ministry of Finance issued a further notification under which the CIF value has been enhanced to Rs 15,000 and last date for import extended to December 31, 1986. The list of wireless apparatus, accessories and components exempted from customs duty is reproduced in Box IV.

In order to avail the customs duty exemption, the importer must have:

1. A valid Amateur Wireless Telegraph Station Licence.
2. A certificate from an officer not lower in rank than an assistant wireless adviser to the government of India in the Ministry of Communications that the quantum of imports of the said wireless apparatus, accessories and components are within the CIF value limits specified in the conditions,

Box III
Frequency Bands, Emission and Power

Frequency Bands	*Category of Licence*			
	Advanced Grade	*Grade I*	*Grade II*	*Restricted Grade*
1820-1860 kHz 3500-3700 " 3890-3900 " 7000-7100 " 14000-14350 " 18068-18168 " 21000 21450 " 24890-24990 " 28000-29700 "	150 watts A1A, A2A, A3E, H3E, J3E, R3E, F1B, F2B, F3E, F3C, A3C, A3F	150 watts A1A, A2A, A3E, H3E, J3E, R3E, F1B, F2B, F3E, F3C, A3C, A3F	50 watts A1A,—A3E, H3E, J3E, R3E	NOT ALLOWED
144 146 MHz	50 watts -do—	-do-	10 watts A1A, A2A, A3E, H3E, J3E, R3E, F1B, F2A, F3E	10 watts — — A3E, H3E J3E R3E, — — F3E
434-438 "	-do—			
1260-1300 " 3300-3400 " 5725 5840 "	25 watts —do—	25 watts —do—	NOT ALLOWED	NOT ALLOWED

Explanation of symbols:

First symbol—Type of modulation of the main carrier

A — Double sideband
H — Single sideband, full carrier
R — Single sideband, reduced or variable carrier
J — Single sideband suppressed carrier
F — Frequency modulation

Second symbol—Nature of signal modulating the main carrier

1 — A single channel containing quantised or digital information without the use of a modulating sub-carrier.
2 — A single channel containing quantised or digital information with the use of a modulating sub-carrier.
3 — A single channel containing analogue information.

Third symbol—Type of information to be transmitted

A — Telegraphy for aural reception
B — Telegraphy for autometer reception
C — Facsimile
E — Telephony
F — Television

and recommending the grant of exemption under the relevant notification.

To obtain the above certificate the importer must apply to the WPC wing of the Ministry of Communications on the prescribed format along with a proforma invoice and technical catalogues from the supplier of the equipment and a draft of Rs 10 as application fee. The ministry on being satisfied shall grant the relevant certificate.

The importer can thereafter approach any scheduled bank for arranging the remittance of foreign exchange either by a draft or a letter of credit. An advance draft can only be issued for imports valued US $1000 or less, otherwise a letter of credit is the only alternative.

Foreign manufacturers

The major world suppliers of ham equipment are based in Japan. The market leaders are Trio-Kenwood, Icom and Yaesu-Musen.

Their addresses are:

1. Icom Incorporated,
   1-6-19 Kamikurazukuri,
   Hirano-ku, Osaka, Japan.
2. Yaesu Musen Co. Ltd,
   7-7, 1-Chome, Yaesu, Chuo-ku,
   Tokyo, Japan.

The above companies are represented in India by their local agents. To our knowledge their local agents are:

1. Basic Electronic Enterprises,
   A/3-4 New Empire Industrial Estate,
   Kondivita Road, J.B. Nagar,
   Bombay 400059.
2. Choice Agencies,

Box IV
List of Wireless Apparatus, Accessories and Components exempted from levy of Customs Duty

Wireless apparatus and accessories

1. HF transceiver (combination of transmitter and receiver) meant for amateur frequencies with accessories in assembled or kit form.
2. VHF transceiver (combination of transmitter and receiver) meant for amateur frequencies with accessories in assembled or kit form.
3. UHF transceiver (combination of transmitter and receiver) meant for amateur frequencies with accessories in assembled or kit form.
4. VHF-VHF or VHF-UHF repeater (combination of transmitter and receiver) meant for amateur frequencies with accessories in assembled or kit form.
5. Transceiver for amateur frequencies in assembled or kit form.
6. Grid dip oscillator.
7. Radio frequency interference filters.
8. Antenna with or without feeders, antenna rotators for amateur frequencies.
9. Balun transformers.
10. SWR bridges or reflectometers.
11. Digital frequency counters (up to 6000 MHz) with accessories.
12. Morse readers
13. Noise bridges.

Components

1. Transistors, diodes, integrated circuits/chips.
2. Thermionic valves or vacuum tubes.
3. Toroidal cores.
4. Quartz crystals.
5. Variable condensers (air-dielectric type)
6. Precision capacitors (fixed type) of value between 1pF to 5000pF
7. Relays.
8. Spare NiCd cells or packs as required or used with items 2 or 3 above (in case of handheld transceivers).
9. Rotary switches.
10. Ferrite beads.
11. Slow-motion tuning mechanism with/without dials.

Note: The CIF value of the said components should not exceed Rs 1000.

Sunflower Flat,
11/VI Carter Road, Bandra,
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Types of equipment

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NOMADS

Photolithographic Techniques for LSI and VLSI

Part I

J.D. Jain and A. Srivastava

Recent progress in electronics has been mainly in semiconductor technology, particularly in the field of silicon technology. LSI (large scale integration) and VLSI (very large scale integration) has resulted from the efforts to increase the packing density of the components as well as the functions of the circuits on each chip.

In the field of process technology, much stress has been laid in the improvement of micron and submicron lithography and thinner films formation technology. In fact, lithographic and etching techniques are the keys to the VLSI leading to increase in circuit complexity, its performance and improvement in wafer process yield.

Lithography is a very old technique developed initially by the graphic arts industry, now utilised extensively in the manufacture of printed circuit boards. It has recently been improved almost to the physical limits of perfection by the semiconductor electronic industry. As applied to semiconductor devices, e.g. ICs, it is common to indicate the very high resolution accomplished by the term 'microlithography'.

Lithography is that part of IC manufacturing process in which detail geometries of microscopic size are obtained. Lithography is used repeatedly during the fabrication of ICs to delineate the areas of IC components in which diffusion, ion implantation, etching and metalisation are to be allowed or prevented. It transfers the geometric pattern of the IC components to a wafer by a mask or by direct writing and permanently establishes the patterns on the wafer by means of etching.

The major characteristics of IC devices are component density, component speed, delay and minimum line width. The minimum line width is expected to reach 0.5 micron, and number of components per IC to 33 million by 1986. These expectations for future devices indicate that lithographic techniques and equipments such as for aligning and exposing must be capable of meeting the minimum line widths and overlay requirements in order to achieve the expected increase in the component density. Lithography shares the largest portion of the total IC manufacturing cost.

In this article, lithographic techniques such as optical, deep UV, X-ray, electron and ion beam have been explained. In the etching process, wet etching and dry process techniques have been covered. Dry process technique covers plasma, ion beam reactive, non-reactive and sputter etching aspects.

OPTICAL LITHOGRAPHY

Optical lithography refers to a means for patterning the resist using actinic radiation in the optical region of the electromagnetic spectrum. This visible spectrum lies between 3800 Å (violet) and 7800 Å (red) radiation for which $\lambda < 3.8$ is called ultraviolet, down to about $\lambda \sim 100$ Å below which they are called X-rays. Radiation of $\lambda > 7.8$ belongs

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Mr J.D. Jain is assistant director of the A&A Division at the Central Electronics Engineering Research Institute (CEERI) of the Council of Scientific and Industrial Research, Pilani, Rajasthan. His co-author, Mr A. Srivastava works at the CEERI Extension Centre, New Delhi.

to infrared. For $\lambda <$ 10um or 10^{-3}cm, the radiations are said to be in the near infrared and for $\lambda < 10\mu$ are said to be far infrared.

A key aspect of fabrication of semiconductor ICs/LSI, VLSI is the precise delineation of patterns in various materials such as silicon, GaAs, etc. Fine line stencil masks (photomasks) provide the medium for patterning the silicon wafers with the multiple layers of circuit element geometries. Photomasks essentially consist of microphotographs of the individual circuit layers. Devices are produced by photolithographic techniques using photomasks on an oxidised silicon substrate which is coated with photosensitive polymers called photoresists or resists.

These resists selectively protect an underlying wafer substrate against chemical or physical attack. For many years now the transfer of design layout on the resist has been accomplished by optical systems (optical lithography) operating at visible light wavelengths, i.e. in the optical region of the electromagnetic spectrum. However, the increasing requirement of smaller geometric features for increased circuit packing density and operating speed, new techniques such as deep UV lithography, X-ray lithography and electron beam lithography have been developed.

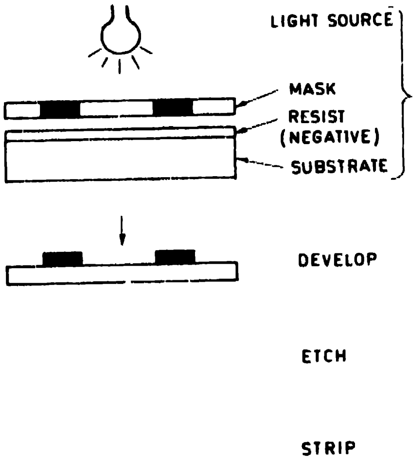

Fig. 1: A generalised photolithographic system.

A generalised photolithographic system is depicted in Fig. 1. The circuit to be replicated is delineated on a thin optically opaque layer, sprayed on a transparent substrate such as glass. This pattern called a mask is transferred on a resist coated wafer by a lithographic exposure system to form an aerial image which consists of a spatially dependent light intensity pattern in the vicinity of the wafer.

Having produced a mask, the next task is to transfer the patterns of each mask on to the wafer surface in order to delineate the regions of doping, insulation, contact windows and connection tracks. To achieve this, the wafer is coated with a light-sensitive film called photoresist or resist and exposed through the mask.

By exposing the resist coated wafer to the aerial image, the resist becomes more soluble (with a positive photoresist) to a chemical developer. This allows for easy removal of the exposed regions. This resist image remaining on the wafer behaves as a stencil for subsequent processing such as etching or metallisation.

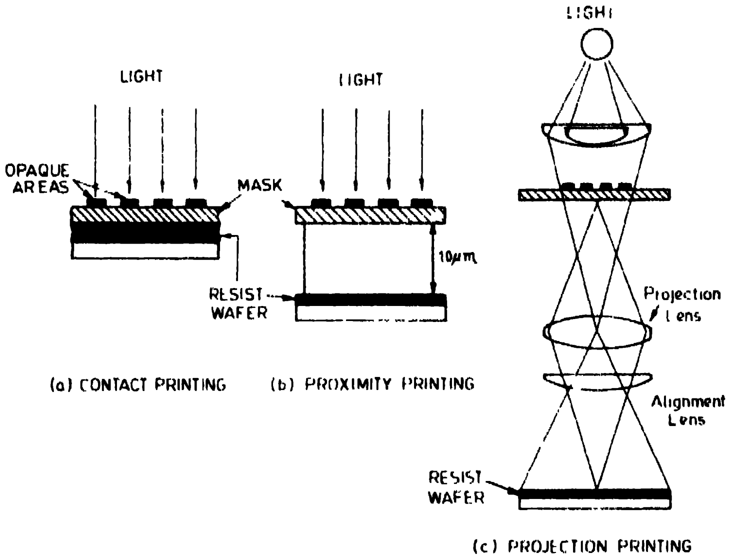

Fig. 2: Three methods of resist exposure: (a) contact printing; (b) proximity printing; and (c) projection printing.

A perfect lithographic process is achieved when the image is an exact replica of the mask pattern, i.e. the image is without loss of information or distortion. However, it is the nature of the physical or chemical process that a perfect lithographic system is hardly ever achieved. As minimum geometries or the wafer become smaller, the lithographic system becomes less ideal. This has stimulated the ever-increasing efforts to develop newer lithographic techniques, to keep pace with the ever-decreasing line widths associated with VLSIs.

Future lithography will be aided by the adoption of trends in processing like high contrast, dry process resists, more uniform wafer surfaces (e.g., multilevel resist structures), lower temperature processing of device wafers and mixed and match modes of lithography.

Optical exposure techniques

Exposure of the coated wafers through a photomask can be performed by any of the three methods shown in Fig. 2. These are: (i) hard contact, (ii) proximity printing, and (iii) projection printing.

Contact printing (Fig. 2a) brings the resist-coated wafer in physical contact with the mask and illuminates the back of the mask with actinic radiation. The wafer is held flat against a vacuum chuck while the back of the chuck swivels in a spherical socket. Contact is achieved by vertically moving the chuck assembly until the wafer is in intimate contact with the mask surface.

In proximity printing (Fig. 2b) exposure takes place with a finite gap between the substrates. During this process, the mask and wafer are separated by about 10 μm during exposure. This is done to reduce the damage resulting during contact.

Advantages

The inherent advantages in contact, proximity printing are the simplicity of the system, and a relatively small capital investment. Contact printing is capable of producing good 1 μm resolution (defined in terms of minimum feature that can be repeatedly exposed and developed) and proximity printing about 4.0 μm features. Since this technique requires a minimal number of optical elements and broadband illumination, higher exposure rates can be achieved.

Disadvantages

There are many limitations that affect the usefulness of contact, proximity printing in VLSI application.

1. The induced mask defects limit the mask life and hence the cost. Depending on the severity of the contact and the size of the die, the life can be from ten to hundred exposures.
2. The process of clamping the wafer between two substrates distorts the wafer surface in an unpredictable manner, making it difficult to get repeatable results.
3. Overlay errors as large as 1 μm are produced.
4. Since highly collimated sources of illumination are used to limit penumbra effects, the coherency in the collimated sources tends to accentuate diffraction effects in the imagery.

Proximity printers operate in the region of Fresnel diffraction where the smallest achievable feature is proportional to $(\lambda Y)^{1/2}$, where λ is the exposing wavelength and Y is the separation between mask and wafer. By decreasing λ, separation Y can be increased without loss of resolution. The operating wavelength of light is about 4000 Å. If this could be reduced to say 2000 Å, as in the case of deep UV region, the mask to wafer separation can be doubled and hence the yield can be improved.

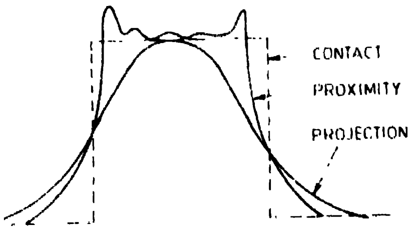

Fig. 3: Photoresist profiles.

Proximity printing provides considerable improvement in the line width control as compared to projection printing.

Projection printing. In order to avoid the damage of the mask due to contact printing, the mask image can be projected onto the wafer. Projection printing offers higher reso- Elect lution than proximity printing and permits a large Scientific aration.

Srivastava projection printing, the image of the mask is projected the wafer through a high resolution lens. The mask is usually illuminated in transmission and the demagnification of the lens may vary between 1 to 20 times.

A projection mask aligner can take many different forms, depending on the type of imaging lens used. Fig. 2(c) shows a basic refractive projection mask aligner to illustrate its component.

The advantage of projection printing is its non-contact operation that prevents the mask from introducing defects and wearing out. Besides saving the cost of making several replacement masks, the wafer images are potentially more uniform because a single mask is used for all of them. The non-contact operation also eliminates the need to move the wafer after it is aligned.

Another advantage can be gained when instead of 1:1 lens a reduction lens is utilised. The mask becomes easier to fabricate and repair. The use of a reduction lens usually reduces the head size which becomes smaller than the wafer and a step-and-repeat operation is required to cover the entire wafer. Though seemingly more complicated, stepping with a small field makes projection printing less susceptible to wafer in plane distortions.

In addition to the complexity and higher cost of a projection lens, the refraction type can only be corrected for one or two wavelengths. Standing waves are often produced in the photoresist image, making line width control more difficult.

(To be continued next month)

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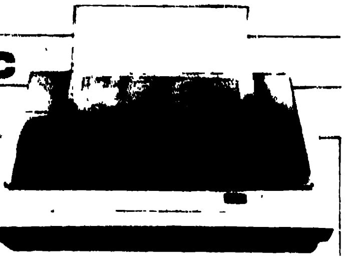

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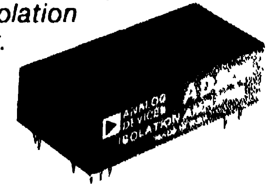

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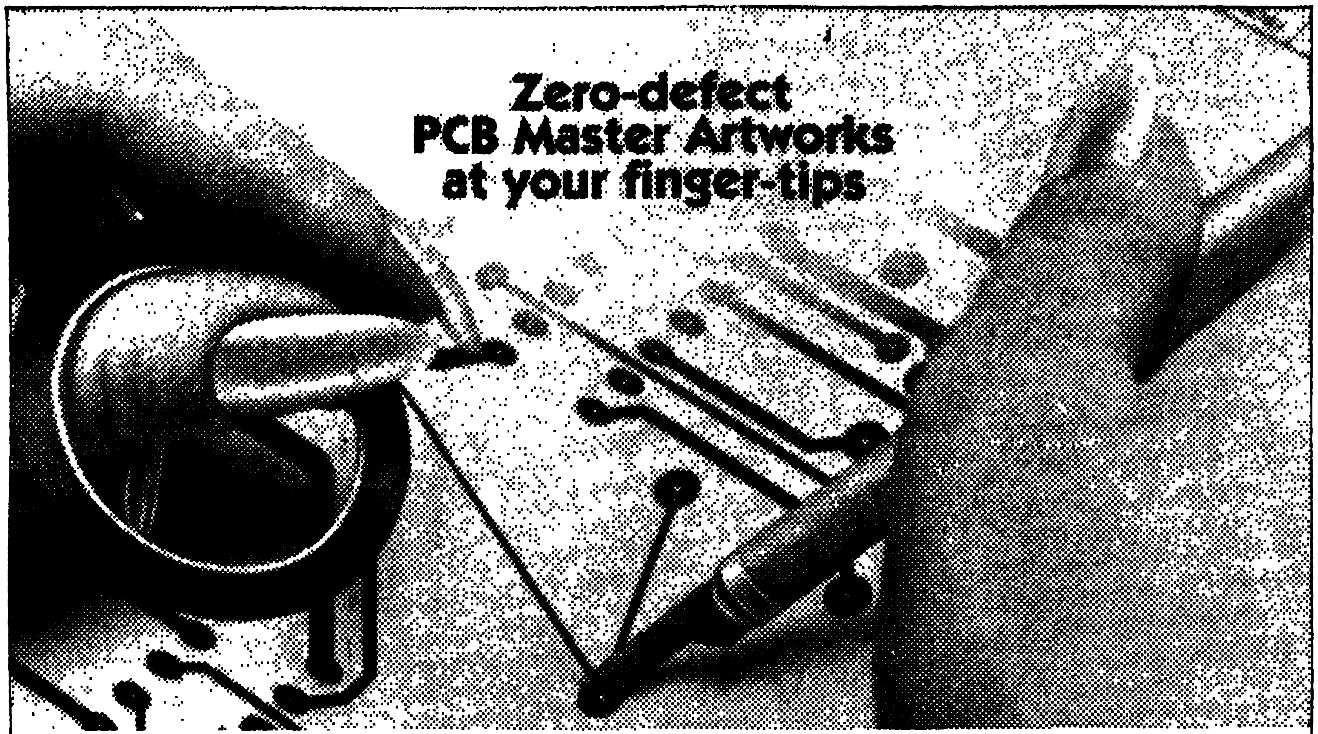

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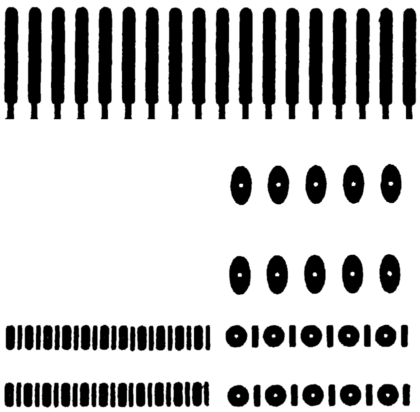

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High Voltage Power Supplies

Nagesh Upadhyaya

High voltage power supplies are special type of DC/DC converters used as power sources in many applications. They are special in that their design and fabrication involves exercise of extra care. Good design techniques result in high voltage power supplies of good reliability.

Following paragraphs give an overview of high voltage (HV) design fabrication and the special care which must be taken to evolve a reliable HV supply.

HV converter

A HV converter can be defined as a power supply where a DC at a lower level is transformed into a DC at higher level

Basic HV converter can be thought of as being an inverter and a rectifier connected in series as shown in Fig. 1.

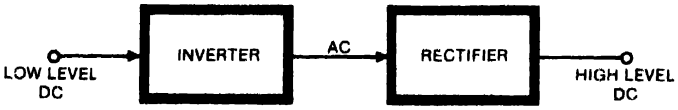

Fig. 1: Block diagram of a basic HV converter.

The inverter converts the DC at lower level to a higher level AC, by first changing the lower level DC to a lower level AC and then using a step-up transformer to get an AC at a higher level. Thus inverters are a special type of oscillators.

The rectifier at the output of inverter changes the stepped-up AC voltage to a DC voltage at higher level. To this basic HV converter, voltage multipliers are added optionally to get still higher voltages, than that got by a transformer without causing its breakdown. Filters and regulators can also be part of HV power supplies like any other low voltage power supplies.

Hence we have the following basic circuits to be discussed for a high voltage power supply (HVPS):

1. Oscillators
2. Rectifiers and voltage multipliers
3. Filters
4. Regulators
5. Controllers

OSCILLATORS

Out of the many circuits which can be used for inversion, the most popular are:

(a) Self-oscillating types. Here again we have two subsections: (i) chopper or push-pull circuits, and (ii) blocking oscillators.

(b) Driven types.

Self-oscillating circuits

In this type, no external drive is given to the switching transistors and they work on the principle of regenerative feedback. A portion of the switching voltage is fed back to drive the transistors.

A general form of push-pull type circuit is shown in Fig. 2. Both the primary and feedback windings are centre-tapped; the secondary can be centre-tapped, if required. T1 and T2 are used as switches to alternately cut on and off the DC (i.e. VCC) to produce chopped output at the primary and hence at the secondary. Due to the feedback action, either T1 (or T2) will be conducting at a time and T2 (or T1) will be off. Once T2 (or T1) cuts off, T1 (or T2) will start conducting. This produces a symmetrical square waveform at the T1, T2 collectors and secondary as shown in Fig. 3.

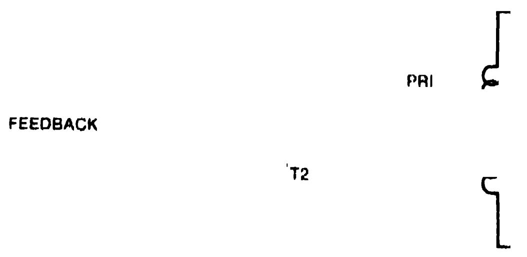

Fig. 2: A typical push-pull circuit.

This circuit has advantages, that (a) very symmetrical waveforms are observed at the output, and (b) core satura-

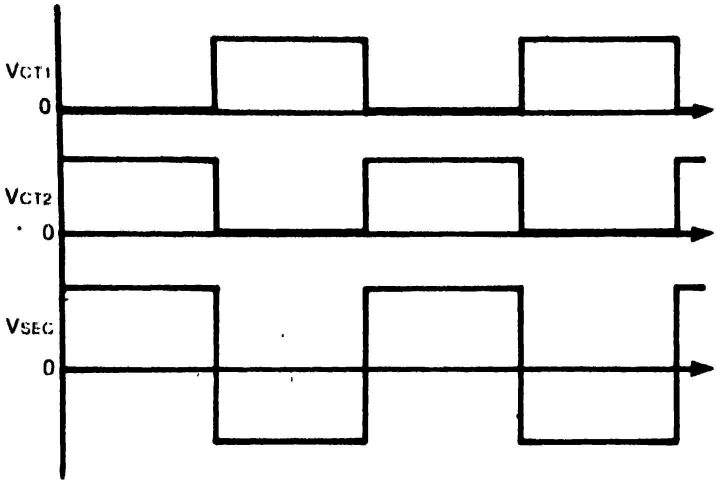

Fig. 3: A symmetrical square waveform produced by a push-pull circuit.

tion is avoided because the transformer is centre-tapped and the core is driven equally in both the directions.

However, the circuit has the disadvantage of higher standby losses and the centre-tapped transformer winding design requiring bifiliar arrangement of wires.

A general form of blocking oscillator circuit is given in Fig. 4. With power on, there is a zero bias on the transistor (T). The collector current starts with leakage in the transistor. Primary rate of change of current induces a voltage in the feedback, which gradually drives 'T' to saturation. At saturation, change in collector current ceases, feedback stops and transistor cuts off, negative voltage existing on the capacitor at the base gets discharged through R, and again the above process repeats.

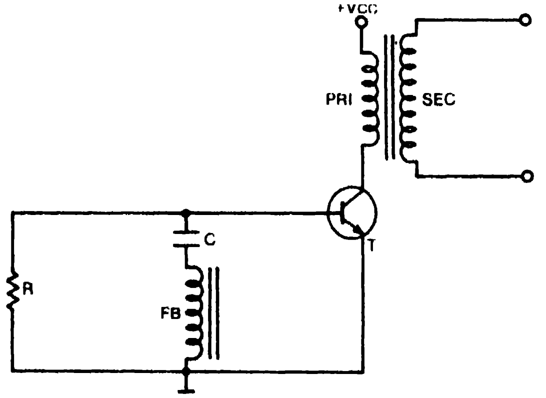

Fig. 4: A typical blocking oscillator circuit.

This produces waveforms at collector of T and secondary as shown in Fig. 5.

As seen in the waveforms at Fig. 5, blocking oscillator design produces slightly unsymmetrical pulses. Even this could be improved by redesigning and adding some other circuit elements, at the cost of extra power. This exercise is not really necessary. The slight asymmetry in the waveform does not matter much, because finally the AC is going to be converted back to DC. More important, standby power can be kept at a lower level in certain low power applications.

Driven type oscillators

This is characterised by an external oscillator driving the final on/off switches connected to the transformer primary. Here also there are two types, single-ended and push-pull, as depicted in Figs 6(a) and 6(b) respectively.

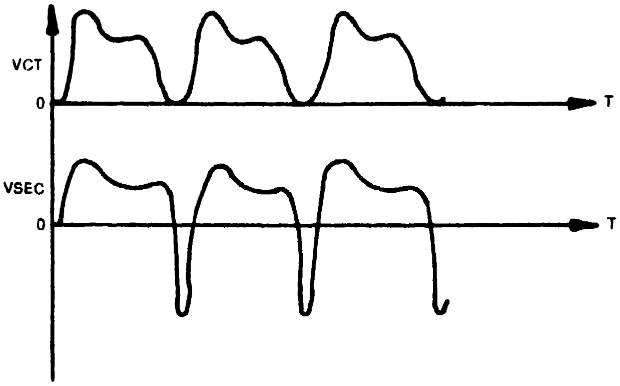

Fig. 5: Output pulses from the collector blocking oscillator transistor.

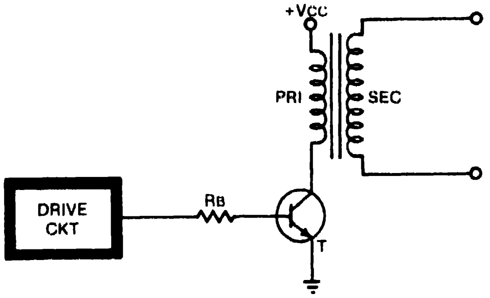

Fig. 6(a): Single-ended driven type oscillator circuit.

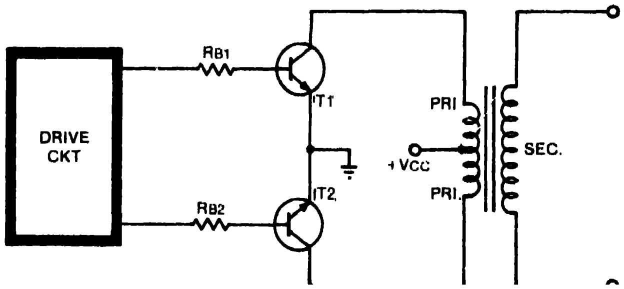

Fig. 6(b): Push-pull driven type oscillator circuit.

Driven-type oscillators have higher standby losses compared to the self-oscillating circuits.

Based on the above discussion, it can be said that, self-oscillating blocking oscillator circuits are used for low-power converters; self-oscillating push-pull types are for medium power applications and driven-type circuits are used for high power sources. In lower power applications, it is necessary to see that the circuit losses do not become comparable with the output power.

Thus the design of an oscillator consists of the following elements:

(a) Choice of switching transistors;
(b) Choice of switching frequency; and
(c) Choice of core and design of transformer.

Choice of transistors

The basic requirements regarding this are: (i) it should be a high frequency transistor, and (ii) it should have higher breakdown voltages.

The second requirement is necessitated because of inductive reactances encountered in the circuit at the primary and feedback. That is to say, transistor should be capable of withstanding high back-emf spikes produced during switch-off of inductors. A rule of thumb is that $V_{CE(max)} = 2V_{CC}$.

If $V_{CC} = 15V$; then $V_{CE(max)} = 15 \times 2 = 30V$.

Further, in switching applications, it is taken that switching power can be about eight times the normal class-A power rating, because during switching operation, the current flow is not continuous.

Hence $P_{SW} = 8P_{AV}$

If $P_{AV} = 800$ mW, then $P_{SW} = 8 \times 0.8 = 6.4W$.

That is, a transistor of 0.8W power rating can be expected to switch up to a maximum of about 6.4W.

A medium hfe transistor can be chosen, since amplification is not a criterion here.

Choice of frequency

This is a trade-off between various aspects. If the frequency is too low, then core size tends to increase; if it is too high, then standby losses in oscillator and core increase. The oscillator frequency is also likely to interfere with other systems, through conducted and radiated emission. So a careful selection, avoiding of frequencies of other systems connected to the same power line, is required.

In general, a frequency of around 2 kHz is used for low power applications, whereas a frequency of about 20 kHz is taken as suitable for medium power applications. Still higher frequencies are being tried out for higher power applications, with power MOSFETs as switches.

Choice of core and design of transformer

There are many types of cores available such as laminated cores, ferrite cores and toroidal cores.

Laminated cores have higher losses at the operating frequencies of the converters and hence they are avoided.

Ferrite cores are fragile; they cannot withstand vibrations and shocks. When reliability is important, ferrite cores fail to satisfy the conditions.

Toroidal cores are best suited for converter applications. These are also known as tape-wound cores. They have minimum flux leakage and hence losses because of their closed magnetic loop structure. A typical cut-away section of torodail core is shown in Fig. 7.

Tape material of the core may vary, as also the tape thickness. Tape material is usually an alloy of iron like deltamax, mumetal, permalloy etc. Tape thickness determines the maximum usable frequency of the core.

As an example, a kind of molybdenum-permalloy has 80 per cent Ni-Fe and 4 per cent Mo as its major constituents. It is recommended for high frequency applications and saturable reactors. Its speciality is that it has high initial permeability, low core loss, low coercive force etc. Regarding tape thickness, some manufacturers have specified that a 0.025mm thick tape can be used for frequencies up to 10 kHz; 0.013mm can be used up to 20 kHz etc.

The core breakdown strength is also an important factor while designing HVPS. It should be at least twice the peak-to-peak voltage appearing across the transformer secondary.

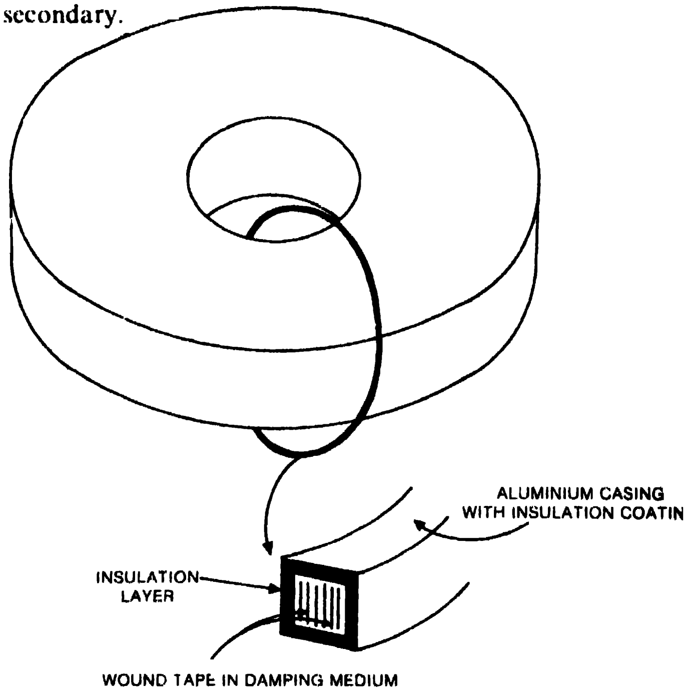
ALUMINIUM CASING WITH INSULATION COATIN
INSULATION LAYER
WOUND TAPE IN DAMPING MEDIUM

Fig. 7: Cut-away section of a toroidal core.

Enamelled copper wires of suitable SWG are wound on the core. Overlapped winding configuration can be used with primary, feedback and secondary coming one above the other. Bifiliar winding gives better results. The size of the core depends on the power output, window area, the turns ratio etc. Turns ratio depends on the output voltages required and output power determines the guage of the wire. In HVPS a turns ratio of 1:20 is not uncommon.

The step-up ratio, if too high, causes breakdown in the secondary winding and hence very high step-up ratios are avoided. Insulation tapes are provided between different layers in the secondary of the transformer. Transformer design starts with the design of primary number of turns. Knowing the frequency of operation, supply voltage and core flux density (B_{max}, specified by the manufacturer) we can calculate the primary turns by the given formula

$$N_P = \frac{E_{(av)}}{4\,B_{max}\,f \times 10^{-8}}$$ for non-sinusoidal waveforms

To calculate the feedback turns (N_F), the following rule of thumb is used

$$\frac{1}{5} < \frac{N_f}{N_P} < 1$$

that is, feedback turns must be more than one-fifth but less than the number of turns in the primary.

To decide the secondary number of turns, it is required to know secondary current, guage of wire, window area of the core etc. 'Window area' is the area in the core which can accommodate all the three windings. Therefore when winding the secondary, the area already occupied by primary and feedback has to be taken into account. With thinner guages of wires it is found that practically a ratio of 30 to 40 can be accommodated, depending on the step-up ratio required, i.e.

$$\frac{N_s}{N_p} \quad 30 \text{ to } 40$$

RECTIFIERS AND MULTIPLIERS

Any of the rectifiers used for low voltage power supplies could be used for HVPS as well. However, care has to be taken for device selection of higher ratings. Minimum two times the worst case operating condition of a device can be taken as a good device derating factor. For example, if a HV capacitor is subjected to say 600V DC as the worst-case condition, then the minimum working voltage of that capacitor has to be 1.2kV DC.

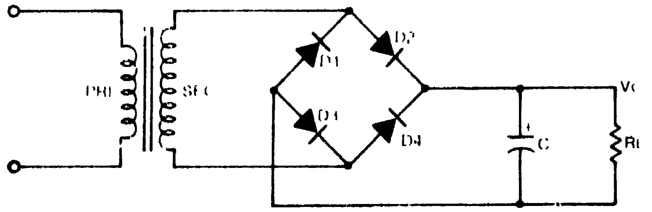

Fig. 8: A full-wave bridge circuit for HVPS.

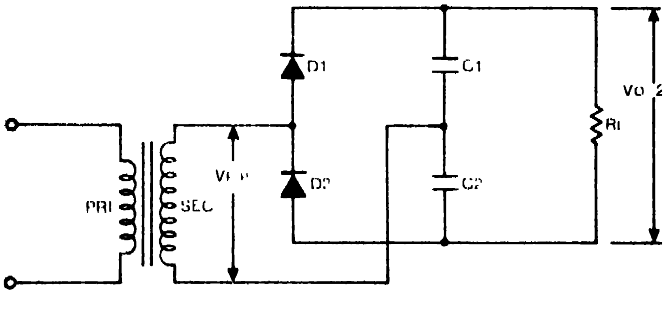

Fig. 9: A conventional voltage doubler circuit.

Depending on the application, a half-wave, full-wave, doubler or tripler can be used in HVPS. For example, a full-wave bridge circuit for HVPS shown in Fig. 8 is no different from that for a low voltage power supply. Note that D1-D4 and C are high voltage diodes and capacitor respectively.

In most cases, the secondary voltage is doubled, tripled or simply multiplied. A conventional voltage doubler circuit is given in Fig. 9.

However, in practice an n-stage multiplier will be used to get higher voltages. Two most popular circuits in this are parallel multipliers and series multipliers (cockroft-walton circuit).

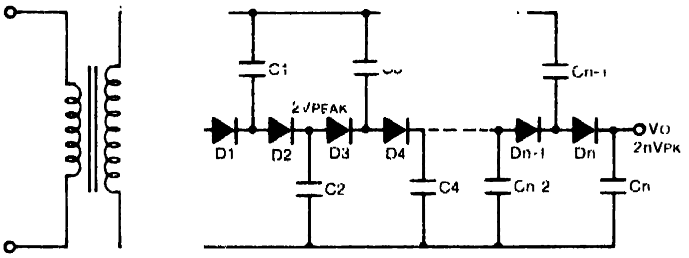

Fig. 10: The circuit for parallel multiplication.

As can be seen in the parallel multiplier circuit (Fig. 10), devices at the later stages have to be of higher voltage rating (almost load voltage). Further, there is no advantage with respect to device reduction or ripple. Hence series multipliers are used.

In a series multiplier circuit (Fig. 11), a maximum voltage of 2 VPK only appears across any device. Hence this circuit is advantageous in using devices of lower ratings. The capacitors used in this are approximated by $C = 9 V_o^2 I_L / 2f(V_{p-p})^2$, where I_L is the load current, f is the converter frequency and Vp-p is the peak-to-peak (2VPK) secondary voltage.

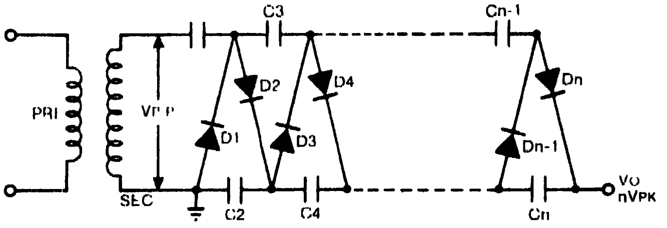

Fig. 11: The series multiplier circuit.

The following points are worth noting with respect to multipliers:

(a) For a given load, as the number of stages are increased, the efficiency goes down;

(b) Increase in number of multiplier stages increases the

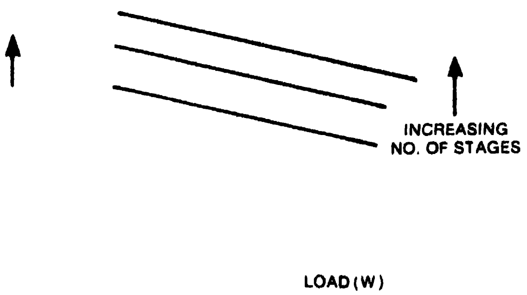

Fig. 12: Load supply vs load consumption characteristics for different number of multiplier stages.

output but the output power that could be supplied comes down linearly (Fig. 12).

Thus the number of multiplier sections have to be optimised. Taking into account the losses encountered in the high voltage sections and to supply any bleeder current, if required, an extra section or two can be incorporated.

FILTERS

Once the DC is available at the output, the next problem is to reduce the AC content in it. That is, filtering. This can be achieved by any one of the standard filter circuits.

Even though L-C filters can be used, by their very nature inductors are bulky which increases weight and space of the system. At lower currents, R-C filters are effective and can be used with advantage.

Simple R-C filters shown in Fig. 13 will serve the purpose. The number of R-C stages required depends upon the ripple that is tolerable in the system. The R and C values can be optimised by referring to charts of ripple attenuation versus RCF for different filter sections. One such useful chart is available in 'Electronic Engineer Handbook' by Landee and Davis (McGraw Hill), whose general form is shown in Fig. 14.

At low-current applications, four to five sections of filters reduce the ripple to acceptable values of 10-20mV. Also, it is found that, metal film resistors in place of carbon composition resistors give improved noise performance because of their uniform structure. Good grounding and shielding is also required. Shielding between multipliers and filters as also between oscillators and filters gives good improvement regarding ripple characteristic.

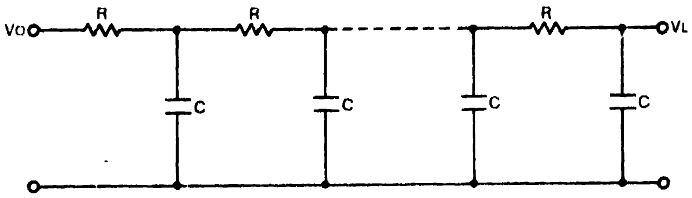

Fig. 13: Simple RC filters.

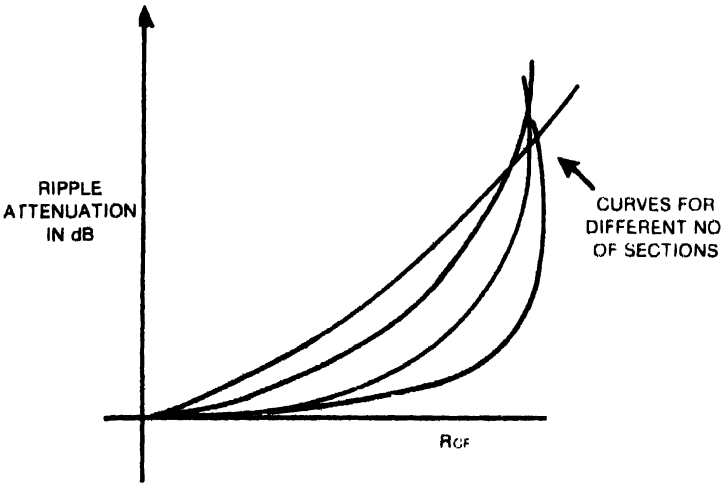

Fig. 14: General waveforms of ripple attenuation.

REGULATORS

Here we can study two types of regulators:

(a) Gas-tube regulators (VR tubes), and

(b) Feedback regulators.

In gas tube regulators, the phenomenon of gas breakdown is utilised for regulating the load voltage. Gas tube is the vacuum tube counterpart of zener diodes. Tubes are connected as shown in Fig. 15. When there is an increase in the voltage, the current (IZ) through the tube adjusts in such a way that load voltage is kept constant.

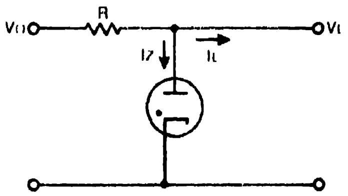

Fig. 15: Vacum tube regulator circuit.

However, tubes are bulky, fragile and occupy more space. Also, since the tubes work in open-loop mode, they do not regulate voltages lower than their own rated voltages. Further, tubes require biasing currents for gas breakdown and regulation. This adds to no-load losses.

Feedback techniques are preferred because they are closed-loop error detection and correction methods. If designed properly, they give very good regulation. Here an amplifier is used in the feedback. Load conditions are sampled and the sample is summed at the input of the amplifier with a constant reference. The amplifier output is made to vary in accordance with load conditions. Here again there are two types, namely voltage controlled and current controlled systems. The general form of voltage controlled system is shown in Fig. 16.

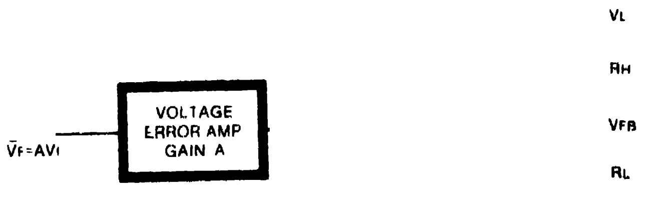

Fig. 16: A typical voltage controlled system.

Load voltage is sampled at VFB using high value resistor RH and low value resistor RL. This is summed at VI with a stable reference voltage VR. Since the reference is constant, VE varies in accordance with load voltage VL.

Current mode control feedback loop system is more com-

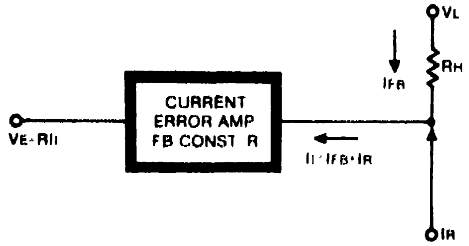

Fig. 17: The circuit for current mode control feedback loop system.

monly used as this simplifies the feedback loop to a one-pole system, which provides reduced phase shift and a more stable loop. Fig. 17 is the general form of this type of circuit.

Load current is sampled using a high value of resistor (R_H). This current (I_{FB}) is combined with a stable reference current (I_R), giving a total current of I_I which is transformed to a voltage (V_E) using an error amplifier acting as a current-to-voltage converter. When there is a change in load, bleeder current (I_{FB}) increases or decreases depending on the load conditions. This causes a change in error current (I_I) which in turn changes error voltage (V_E).

This error voltage change from either of the systems described above is made to control the drive of the oscillator circuit in such a way that, depending on load changes, the drive to the oscillator increases or decreases and hence the terminal voltage remains at a constant level.

CONTROLLERS

Drive control can be either by amplitude variation or by frequency variation.

The simplest form of amplitude controller is a series pass transistor as shown in Fig. 18. The base drive of transistor is varied by V_E which gives a varying V_A at the emitter. Hence the input supply voltage V_{CC} is varied in accordance with error voltage to give a controlling output. The disadvantage here is the power dissipated in the series pass transistors. But the control is simple.

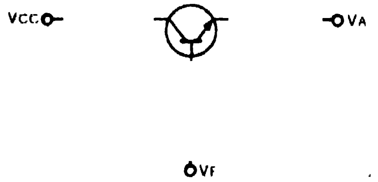

Fig. 18: A simple form of amplitude controller.

In frequency control methods, on/off times of the output transistors are varied in accordance with error voltage. Higher the error, more is the transistor on time. This gives a higher output, correcting the reduced output voltage. This method is advantageous as it gives better regulation and efficiencies. Known as pulse width modulation (PWM) technique, it is the latest in the field of high-power, high-efficiency switchers. A single IC does the job of this PWM.

Now we can see some of the miscellaneous aspects, problem areas and special precautions to be taken in HVPS.

Losses

Following are the losses encountered:

(a) Losses in regulating circuits, error amplifiers etc (i.e. losses in associated circuitry).

(b) Losses in the transformer cores.

(c) Losses in diodes, capacitors and resistors of high voltage multiplier and filter sections (switching losses).

(d) Losses due to stray capacitance in the transformer windings.

Avoiding HV discharges

Corona and arcing are the most common problems under HV discharges. Following steps have to be taken to avoid these:

(a) HV sections are to be separated from low voltage sections in the power supply.

(b) Isolation has to be provided with input transformers and optocouplers.

(c) HV components have to be highly derated and choosing components specially manufactured for HV applications is a better design practice.

(d) Surfaces of cards etc where HV sections are wired, have to be clean and without any deformities.

(e) HV printed circuit card layouts have to be specially done to avoid any sharp corners, as this may lead to corona discharges.

(f) HV lines and ground lines have to be spaced as wide apart as possible to avoid arcing.

(g) Components spacing should also be taken care of so that the HV points and low-voltage points do not come nearby.

(h) HV transformers have to be well insulated.

(i) Solid encapsulants or potting compounds have to be used to cover the HV sections.

(j) Voids or discontinuities in the potting compounds have to be eliminated.

(k) To avoid damage to the components because of corona or arcing, additional circuitry has to be incorporated to detect these and shut off the HVPS.

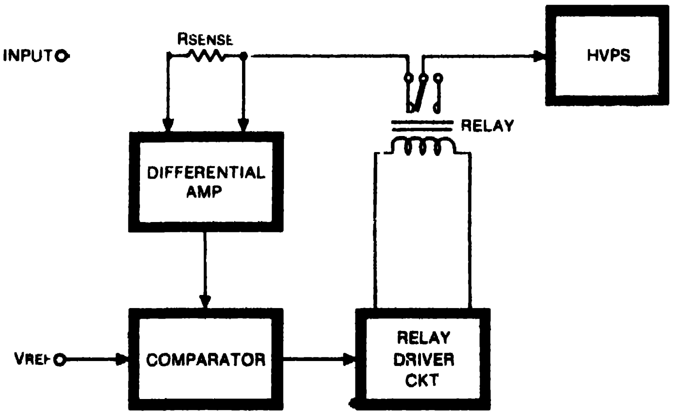

Fig. 19: The current sensing circuit to detect sudden rise or fall in current.

Incidentally, corona/arcing is detected by either a sudden rise in the input current or a drop in load voltage. To detect this, a simple current sense circuit at the input can be incorporated as shown in Fig. 19.

Safety procedures in testing and handling of HVPS

(a) HVPS have to be located at isolated places where there is minimum movement of personnel in the testing area.

(b) Red danger boards have to be made in both local language and English, and they have to be displayed at prominent places while HV testings are being carried out.

(c) HVPS should never be kept on in the absence of testing personnel and HV points should be well insulated.

(d) Persons should be educated about the hazards of HV shocks.

(e) Well insulated and rated equipment have to be used for HV measurements.

(f) Built-in bleeders have to be provided for discharging HVPS when put off in the absence of loads.

(g) Only qualified pesonnel should handle HVPS.

(h) Special HV cables have to be used for HV connections, thus avoiding any leakages.

Finally, we study some aspects which are considered crucial in the functioning of HVPS. Here an attempt is made to define and differentiate some of the terms which are mostly heard in connection with power sources.

Corona

When the voltage gradient between two electrodes exceeds a certain critical value, there is ionisation of air surrounding the conductors, and a luminous discharge occurs. This is known as Corona.

Corona onset voltage is governed by a law known as Paschen's Law. Paschen's Law states that, in a uniform field the corona onset voltage is dependent on both the pressure and the distance between the electrodes. Thus,

$Vs = f(p,d)$

The general form of corona onset voltage as a function of pressure times distance is given in Fig. 20.

We can see that as the pressure is decreased or distance between electrodes is decreased, corona can occur at lower voltages. But after reducing the pressure to a certain level, the corona onset voltage again increases. This is because at higher vacuum, there will be lesser number of free molecules to cause corona.

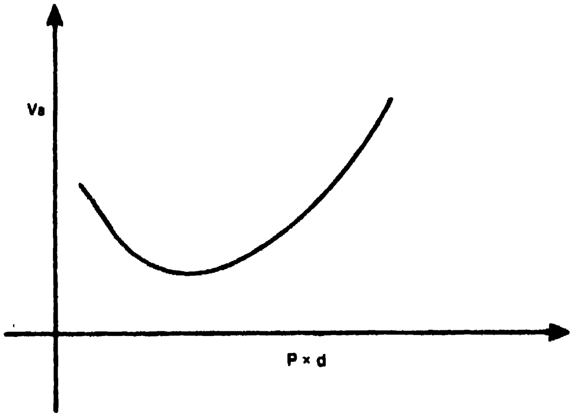

Fig. 20: A curve indicating the general form of corona onset voltage.

Corona is a localised discharge and is limited to the region surrounding the conductor in which the electric field exceeds a certain value.

Corona is characterised by a bluish purple glow in the vicinity of the electrode with smaller radius of curvature. Also, there is an abrupt increase in the current flow from one electrode to the other.

For a self-sustaining corona discharge, the ratio of effective local field to gas pressure is an important factor. It occurs in the nearness of conductors of small radius of curvature subjected to non-disruptive, intense electric fields such as electrical power lines, sharp points at high voltages, etc.

Though corona is responsible for power loss, RF noise and insulation faults, it finds applications in dust precipitation, electrostatic painting, commercial generation of ozone, telecopying etc.

Arc

This is defined as a discharge of electricity through a gas, normally characterised by a voltage drop in the immediate vicinity of the cathode approximately equal to the ionisation potential of the gas.

Arcing is a continuous luminous discharge of electricity across an insulating medium. During arcing usually there is a partial volatisation of the electrodes. Fig. 21 shows a typical curve, which indicates the transition to arcing.

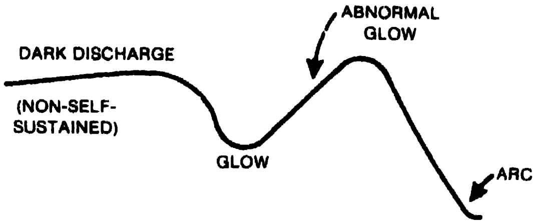

Fig. 21: A typical curve indicating transition to arcing.

Dark discharge sets on with breakdown voltage. After this voltage, the current increases rapidly. With the occurrence of space charge phenomenon, the discharge passes through various stages of glow discharge, and finally when the voltage increases again discharge goes into arc region.

It should be noted that the power supply connected to the electrodes should have both a high voltage and sufficient power for the maintenance of an arc and that the highest voltage has to be applied for the short duration. Thus an arc can be formed by making the two electrodes come into contact with each other and then separating them. The thermionic emission at the cathode forms the arc and because of power supply, arc is sustained when electrodes are moved away.

Arc is characterised by high current density, high luminosity and fast-potential changes in front of the electrodes. Also, if the gap between the electrodes is already ionised, a lower voltage is required to strike an arc.

Spark

It is a disruptive discharge. Sparking occurs when there is a sudden and large increase in current through an insulating medium due to the complete failure of the medium under dielectric stress. Spark generation is by the physical contact of two electrodes at different potentials. Sparking is a discontinuous or a non-sustaining phenomenon in that once the electrodes are firmly in contact with one another, sparking ceases to exist till the time the electrodes are separated again. Only at the time of making or breaking an electrode-to-electrode contact sparks are observed.

Sparking is characterised by brilliantly luminous phenomenon of a short duration. With sparking there is a flash of light. Sparking is also known as sparkover. ☐

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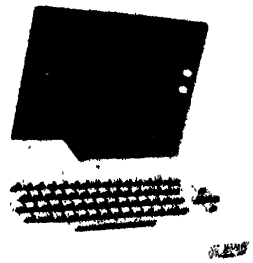

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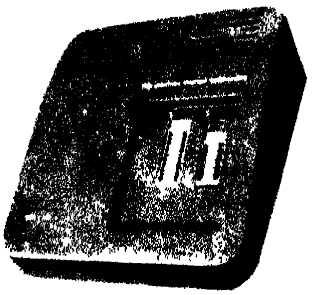

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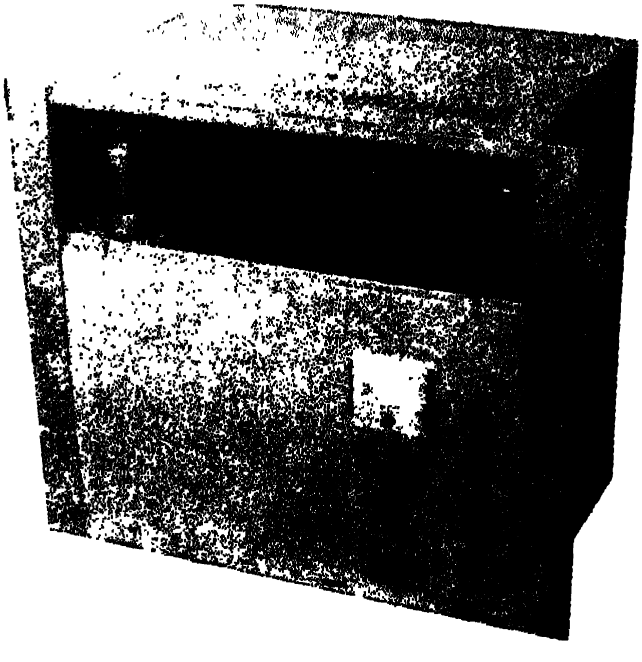

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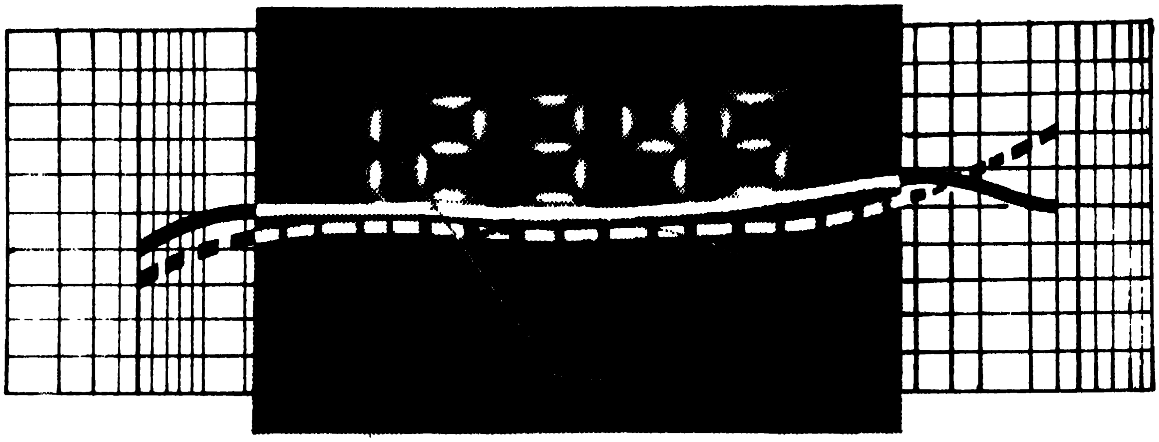

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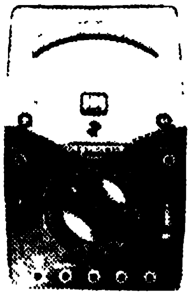

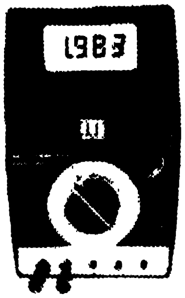

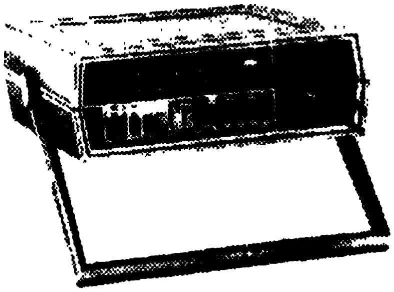

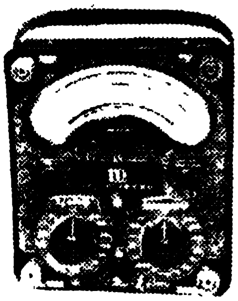

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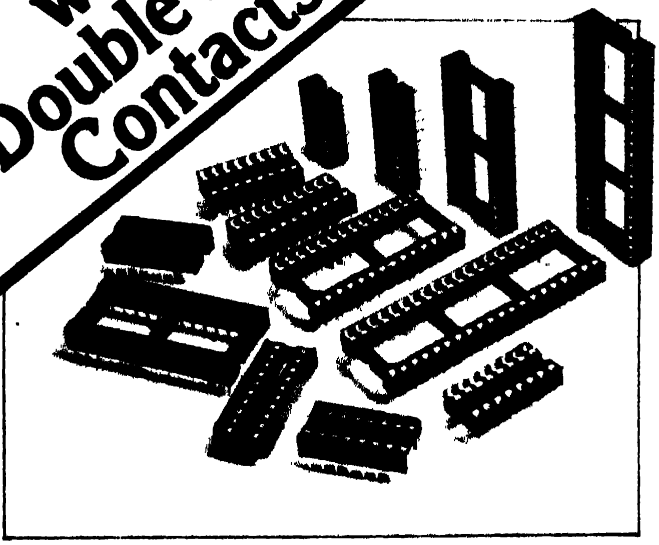

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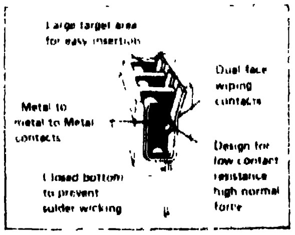
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A Zero-Cost, Infinite-Life Soldering Iron

For Electronics Experimenter

P. Narasimha Rao

The wide variation prevailing in the supply voltage (152-275V) has become more a common thing than an oddity in our metropolitan lives. It is a miracle how any simple, reasonably priced electrical equipment (without any sophisticated protection device) can survive long enough to pay back the investment made on it!

The soldering iron, for example, which is widely used by electronic experimenters is one victim of this. There are instances of burnt out soldering irons even within the first 30 minutes of their maiden life. An average electronics hobbyist is likely to have a good collection of burnt out soldering irons even after many attempts at reconditioning. In my junk box, I have a Henly 65W, a Sushma 35W, Tony 100W and 35W and more than half a dozen deluxe 10Ws of different brands—all rusting and useless.

Sometimes the time spent in reconditioning these irons with new elements doesn't seem worth compared to the cost of the replacement-element, the labour involved and above all, its subsequent service life. This is the situation we face frequently even if we operate these devices through a voltage stabiliser. Many times, operating a soldering iron without failure has come to be more of a problem than the fabricated equipment.

In this article, a method of reconditioning damaged soldering irons to carry on the hobby without tears is given.

The way out

The secret of the remedy lies in replacing the existing element of the soldering iron operating off 220V by an element prepared by the experimenter out of the nichrome ribbon-element wire salvaged from any burnt out and discarded element of domestic electric irons. The only inventory involved is a scrapped 10W deluxe soldering iron and a discarded element of a domestic electric iron, both of which are likely to be in the collection of our electronics hobbyists' junk box.

One more item needed to provide the necessary supply to operate the gadget is a mains transformer (any wattage above 20W) salvaged from one of the condemned or abandoned old valves-operated mains radios now obsolete. This may not be a problem; any experimenter handling electronics for a long time can easily find one in his junk or the item can be procured from any old radio service shop. The secondary HT leads of this transformer should be cut short and the shortened ends should be properly isolated and insulated. A 230/12V, 3A transformer may serve the need as an alternative.

How to rig up

The construction details pertaining to a 10W, deluxe type soldering iron, a popular type for the present-day electronic work involving ICs, are given here. Once the technique is mastered, one can apply it to any type of soldering iron, of any wattage with some modification. The steps involved are as follows:

First, dismantle the scrapped 10-watt deluxe type soldering iron (Fig. 1), carefully salvaging all the components including the ceramic beaded lead-in wires attached to the burnt 220V, 10W element. Check the copper soldering bit for oxidation and pitting. If much pitting is observed on the flat portion of the copper bit after scrapping all the oxide scales, better take another one.

Next, carefully salvage the ribbon-element wire (nichrome) from the burnt domestic electric iron element (say, 600-watt) specifically choosing that portion of the element which has not lost its metallic lusture. Measure a length of 35 to 38 cm of this element, remove all the kincks and folds and determine its electrical resistance (the low resistance range of your H-20 or P-3 multimeter can do the job). Cut the wire to such a length that its resistance is 7 to 8 ohms. Preserve some of the mica of the element not damaged due to excess heat for use later as an insulating medium between the nichrome element wire and the copper bit.

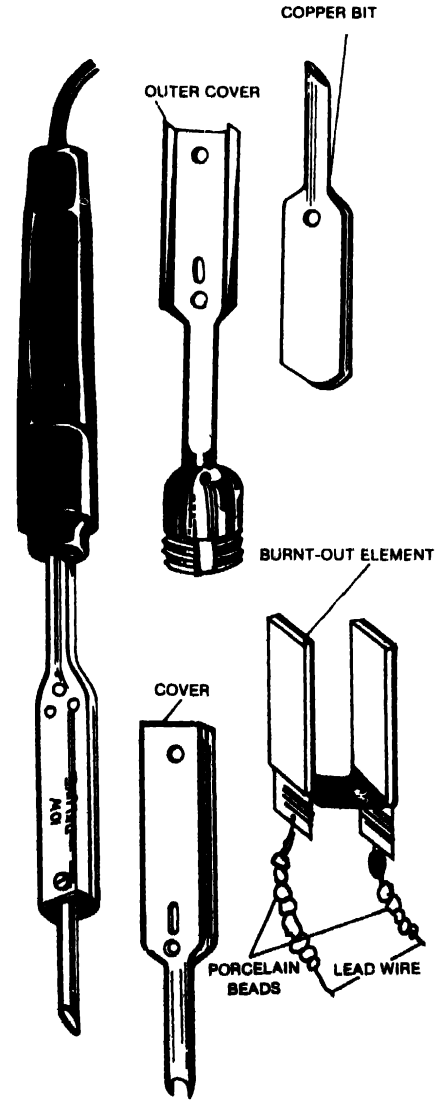

Fig. 1: Soldering iron disassembled.

Wrap one-and-half layers of a very thin rectangular sheet of this mica around the flat part of the copper bit to cover it. Since the voltages involved are going to be very low (11.3 to 12V), and there is no risk of shock, this mica can be as thin as possible, sufficient only to eliminate physical contact between the nichrome wire and the copper bit to avoid short-circuit. This ensures low resistance to heat transfer and high efficiency in operation of the soldering iron.

Next, wind the 35-38cm flat element wire around this mica-wrapped copper bit as shown in the Fig. 2, initially running a portion of the beginning of the wire (about 4 to 5 cm) between the first full layer and the extra half layer. Then completely wind the entire length of the 35-38 cm long wire in the form of a single layer coil, as close as possible, without adjacent coils touching each other to avoid any short-circuit. This covers almost the entire length of the flattened portion of the copper soldering bit below the hole meant for securing the bit to the iron sheet metal covers. The final end of the element wire, after winding, may be secured by making a small hole at the bottom projection of the mica-wrapping and by passing out the wire end through it.

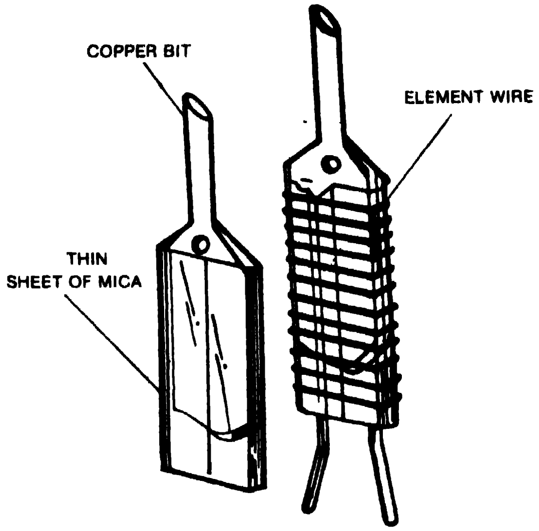

Fig. 2: Winding details on copper bit.

Now attach the ceramic-beaded lead wires to the two ends of the wound element wire and isolate the free ends to prevent them from touching each other as well as the iron metal, by placing thick folded mica pieces around the twisted ends.

Once again wrap around this finished element a thick sheet of mica and secure it to the element wound around the bit firmly by winding a few turns of 30SWG copper enamel wire (taken from the secondary of any burnt out output transformer or a damaged tubelight choke) in the form of helix, twisting the ends together. With this the major job is over; the rest of the work is just conventional, which is done as if you are replacing the element of your soldering iron.

Bring out the ceramic protected element leads throughout the bakelite handle. Place the old asbestos padding on either side of the reconstructed element, carefully match the copper bit hole with those of the sheet metal body covers and assemble the parts. Secure them in position by the screw and nut, putting washers on either side. Attach the element lead wires to the supply cable as done originally, to finish the work.

Test the construction for any short circuits, and if every thing is alright, give the supply of 12V AC and look for the heating of the bit tip. The heating time and the efficiency of operation depends upon how neatly the job is done, and the thickness of the mica-insulation given between the bit copper and the element wire.

The whole operation takes just a couple of hours. Since there is nothing to lose, you can make a few trials in improving the work which will certainly reward in the long run.

The current flow through the iron would be around 1.25A to 1.5A, which is much below the amperage of the element wire. This ensures long life and rugged operation, and you can carry on soldering without any fear of burning it, that usually lurks in the minds of the hobbyists. □

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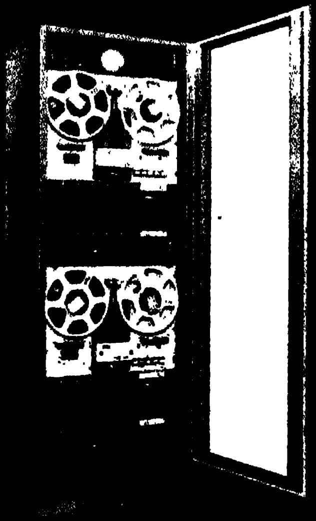

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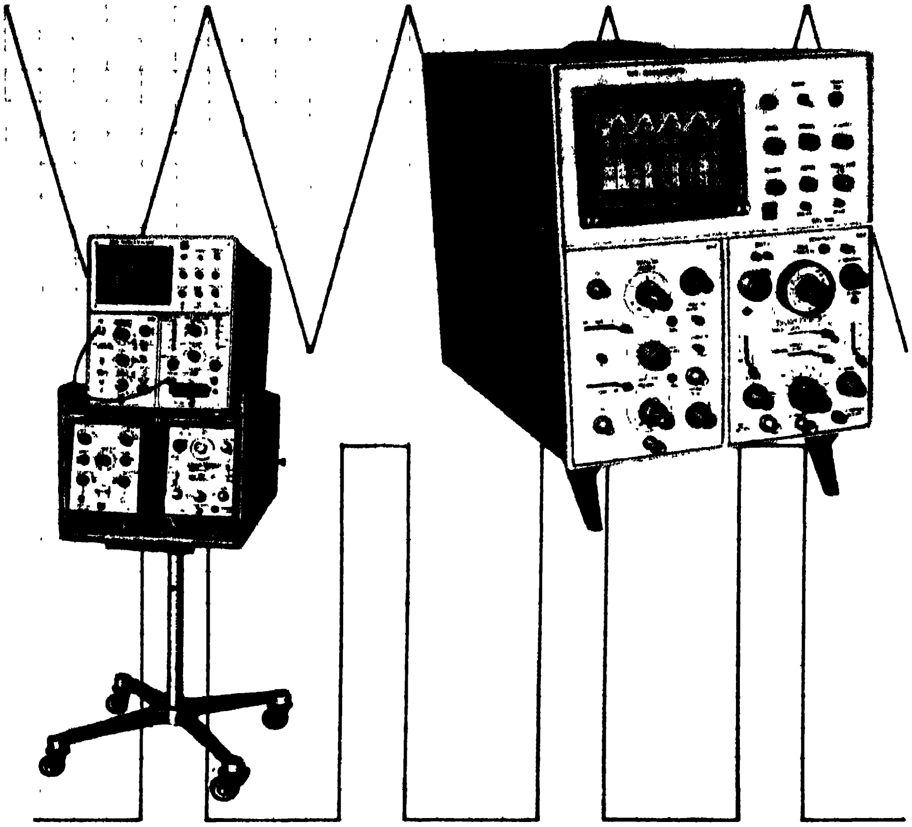

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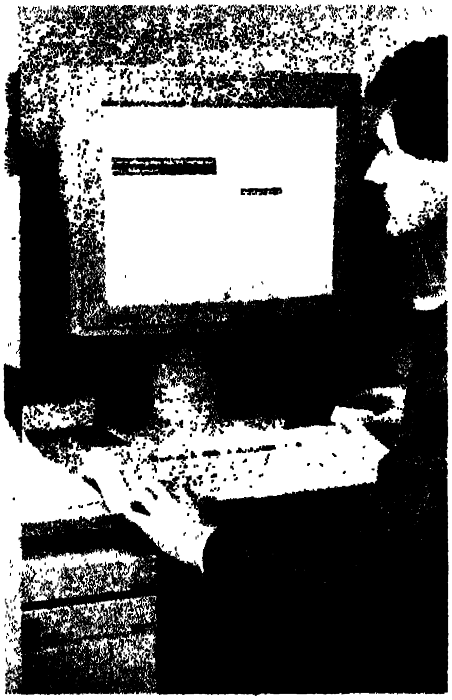
Computer Corner

Versatile laser printer for 5800 office system

Siemens recently presented a number of interesting innovations in the office system sector at the Hanover Fair CeBIT 86. Of particular interest was the 5834 desk-top laser printer and the 5822 workstation system for the 5800 office system. The new laser printer is smaller and, with its additional copying function, more versatile than previous models. The new 5822 workstation system features a 47.5cm screen with more than one million individually addressable picture elements, on which the contents of two DINA4-type pages can be represented side by side.



Versatile laser printer

The desk-top version of the 5834 laser printer is capable of printing ten pages of text or graphics per minute in a variety of typestyles, including modern, classic, titan and others [with as many as nine different sizes]. This is much faster than conventional printers for personal computer applications. The new unit has been developed like a PC printer for direct office use.

With a monthly capacity of 5000 or more pages, the 5834 laser printer is the ideal partner for the 5800 office system. In this case it serves as a departmental printer for the workstation systems. The printer is linked to the Siemens PC-D by way of the bus network. However, it can also be connected as a local printer for off-line workstation systems; it can even be used as a copier.

With its 512kB [or 768kB] main memory and 42MB fixed-disc storage, it resembles the 5835 office laser printer for centralised 5800 office system applications.

Computer installations in India

Presently there are about 17,000 to 18,000 computer installations in the country out of which about two per cent are mainframe computers, 20 per cent minicomputers and the rest microcomputers including wordprocessors, personal computers and accounting/invoicing machines.

All mainframe range of computers are imported, followed by minicomputers, about 70 per cent and microcomputers, about 10 per cent.

The five top Indian manufacturers of computers selected on the basis of production for the year 1985 are: DCM Data Products Ltd [turnover Rs 95.4 million], Electronics Corporation of India Ltd [turnover Rs 152.3 million], Hindustan Computers Ltd [turnover Rs 171.1 million], International Computer Indian Manufacture Ltd [turnover Rs 121.8 million], and Wipro Information Technology Ltd [turnover Rs 119.4 million].

The government has also initiated a number of computer courses at different levels. In addition, a number of programmes, on continuing education, in-service training, short-term courses, evening courses, teachers' training programmes and use of new techniques like computer-aided instructions, audiovisual instructions as well as the use of television network are being undertaken/planned.

Murugappa to market Maxell floppy diskettes

Murugappa Electronics has been appointed exclusive marketing agents in India for all the magnetic media products manufactured by Hitachi Maxell Ltd, Japan. Under this arrangement, it will supply wellknown 'Maxell' brand floppy diskettes.

As one of the world's leading manufacturers of magnetic memory media, Maxell is a trusted name amongst the world's computer manufacturers as well as users of floppy diskettes everywhere which are backed by sophisticated research and development.

Murugappa's associate company, Ambadi Enterprises Pvt Ltd, a recognised export house, will be importing these floppy diskettes on its behalf for stock and sale in India. The range of floppy diskettes available includes: 20.32cm double-side, double-density in soft sector; 20.32cm single-side, double-density in soft sector; 12.35cm double-side, double-density in soft sector [48 TPI]; 12.35cm double-side, double-density in soft sector [96 TPI]; 12.35cm single-side, double-density in soft sector [48 TPI]; and 12.35cm high-density [1.2 MB].

Signal Generator Program for Sinclair Spectrum Micro

Ajay Chikersal

This project turns your Spectrum into an accurate and reliable signal generator source capable of generating square-wave signals in the frequency range 10 Hz to 10 kHz.

It is essentially a software project which can serve as a great utility for hobbyists and experimenters. However, unlike ordinary generators, this one is programmable, i.e. both frequency and duration can be made to vary with time. The frequency can be varied in steps of a single hertz (Hz), and the duration can be as low as a single time period of the pulse.

Though the BASIC program given (see box), may seem to be the heart of the project, the actual generation of pulses is achieved by a machine code routine situated in the ROM. The BASIC program handles routine duties such as accepting inputs from the keyboard and neatly displaying titles and options available.

Working

The machine code routine in the ROM was not initially meant to produce frequencies in such a range; it was designed to be used in conjunction with the Spectrum's BASIC statement 'BEEP'.

The BEEP statement has the format:

BEEP duration, pitch

where the duration and pitch represent any numerical expression. The duration is given in seconds and the pitch is given in semitones above middle 'c'.

When such an instruction is encountered during the execution of a BASIC program, the two variables (pitch and frequency) are used to set certain prerequisites to the machine language program which is subsequently 'called' to produce the desired effect.

As we would have to make repeated references to this machine language routine, we will have it known by the name 'Beeper'.

As we need a more flexible system than that provided by Uncle Clive (Sir Clive Sinclair), we will make use of the Beeper routine directly without referring to the BASIC interpreter.

The Beeper routine was however not intended for direct use by humans. Hence, before calling this routine we would have to preset certain conditions which depend upon the frequency and duration.

So, by now it should be quite clear that the role of the BASIC program would be to:

(a) Accept inputs from the user;

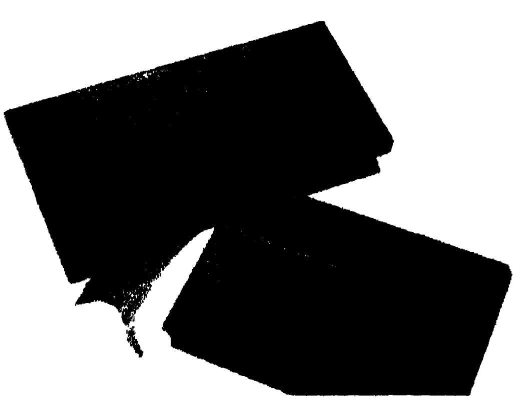
(b) Set the prerequisites to the Beeper; and

(c) Call the Beeper routine.

The prerequisites required for the Beeper program are in

Program Listing

```
10   REM ************************
20   REM *******SPECTRUM*********
30   REM ***SIGNAL GENERATOR****
40   REM *                      *
50   REM **AJAY CHIKERSAL 1986**
60   REM ************************
70   REM MACHINE CODE IS STORED FROM ADDRESS-32000
80   CLEAR 31999
90   FOR T=32000 TO 32009
95   READ A
100  POKE T,A
110  NEXT T
120  REM DATA FOR MACHINE CODE PROGRAM FOLLOWS
130  DATA 33,0,0,17,0,0,205,181,3,201
135  CLS
140  BORDER 1: PAPER 7 : INK 1
150  PRINT AT 2,12;"SPECTRUM"
160  PRINT AT 3,12;"▬▬▬▬▬▬▬▬"
170  PRINT AT 6,8;"SIGNAL GENERATOR"
180  PRINT AT 7,8;"▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬"
190  PRINT AT 15,0;"ENTER THE FREQUENCY
200  INPUT F
210  IF F>=10 AND F<=10000 THEN GOTO 250
220  PRINT AT 15,0;FLASH 1;"FREQUENCY RANGE IS 10-10000Hz"
230  FOR Y=1 TO 300
240  NEXT Y
245  GOTO 190
250  PRINT AT 15,20;F;" Hz"
260  PRINT AT 19,0;"ENTER THE NUMBER OF CYCLES REQD."
270  INPUT N
280  IF N>=1 AND N<=65535 THEN GOTO 320
290  PRINT AT 19,0;FLASH 1;"No. OF CYCLES RANGE IS 1-65535"
300  FOR Y=1 TO 300
310  NEXT Y
315  GOTO 260
320  PRINT AT 20,12;N
330  FOR Y=1 TO 300:NEXT Y
340  REM THE VALUES OF HL AND DE ARE COMPUTED
360  LET DE=N
370  LET HL=(437500/F)-30.125
375  REM DE IS BROKEN INTO HIGH AND LOW PARTS
380  LET D1=INT(DE/256)
390  LET D2=DE-256*INT(DE/256)
395  REM THE VALUE OF DE IS STORED IN MEMORY
400  POKE 32005,D1
410  POKE 32004,D2
415  REM HL IS BROKEN INTO HIGH AND LOW PARTS
420  LET H1=INT(HL/256)
430  LET H2=HL-256*INT(HL/256)
435  REM THE VALUE OF HL IS STORED IN MEMORY
440  POKE 32002, H1
450  POKE 32001, H2
460  CLS
470  PRINT AT 2,12;"SPECTRUM"
480  PRINT AT 3,12;"▬▬▬▬▬▬▬▬"
490  PRINT AT 6,8;"SIGNAL GENERATOR"
500  PRINT AT 7,8;"▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬▬"
510  PRINT AT 10,7;"FREQUENCY=";F;" Hz"
520  PRINT AT 12,7;"DURATION=";N/F;" SECONDS"
530  PRINT AT 14,7;"No.OF CYCLES ";N
540  PRINT AT 16,0;FLASH 1;"SQUARE WAVE SIGNAL OUTPUT
550  RANDOMIZE USR 32000
560  PRINT AT 16,0;"
570  PRINT AT 17,3;"PRESS-R TO RESTART"
580  PRINT AT 19,9;"E TO EXIT"
590  IF INKEY$="E" THEN STOP
600  IF INKEY$="R" THEN GOTO 135
610  GOTO 590
```



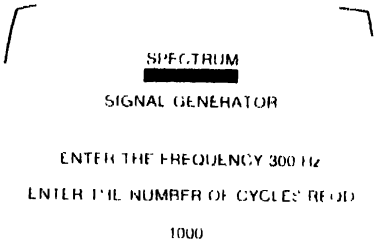
fact values which must be assigned to two double pair registers. These values are obtained by mathematical formulae which contain the variables' frequency and duration.

For the benefit of those readers who are not familiar with machine language, a detailed explanation of the entire concept is given so that this technique can be incorporated in other programs or applications.

The term 'machine language' refers to a low-level language which is native to the computer. In the Spectrum we have a Z80 microprocessor and hence the use of Z80 machine language is required whenever we want to communicate with the computer in its native tongue.

Machine language, like any other programming language, uses 'variables' which can be assigned different values. Registers can also be thought of as variables. There are many registers in Z80 assembly language, the most commonly used being A, B, C, D, E, H and L.

Each of these registers can hold any one number (one byte) between 0 and 255, inclusive of both. Since in practice we cannot restrain ourselves to such small numbers, two registers may be combined to collectively represent larger numbers. These combinations are strictly given by the pairs BC, DE and HL. We will be concerned only with the values of HL and DE as these should be set before 'calling' the Beeper routine.



SPECTRUM

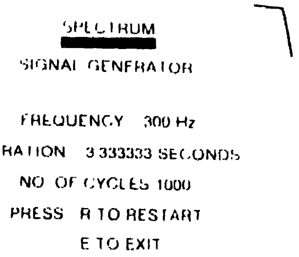
SIGNAL GENERATOR

ENTER THE FREQUENCY 300 Hz

ENTER THE NUMBER OF CYCLES REQD

1000

Fig. 1(a): The initial parameters and sample values.



SPECTRUM

SIGNAL GENERATOR

FREQUENCY 300 Hz

DURATION 3 333333 SECONDS

NO OF CYCLES 1000

PRESS R TO RESTART

E TO EXIT

Fig. 1(b): Display of initial parameters while output of the signal is available through the 'EAR' socket.

When we couple two single registers to form a double register, we can handle numbers between 0 and 65535, i.e. a total of 65536 numbers (256 × 256 = 65536).

The formulae which relate HL and DE to the frequency and duration are:

For register pair HL:

$HL = (437500/\text{Frequency}) - 30.125$

and for register pair DE:

$DE = \text{Frequency} \times \text{Duration}$

As the time period 't' is given as

$t = 1/F$,

$\therefore$ Duration $=$ Time period $\times$ Number of cycles

$=$ Number of cycles/Frequency

Rearranging the above, we obtain

Duration $\times$ Frequency $=$ Number of cycles

where the duration is in seconds and the frequency in hertz.

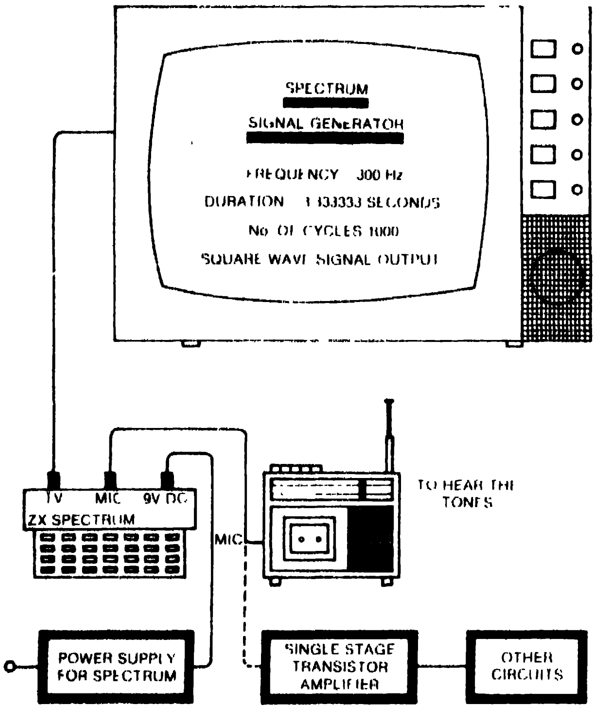


Fig. 2: Applications and final set up.

Thus, DE represents the number of cycles that will be produced. This can be specified between 1 and 65535, including both.

Let us now calculate the theoretical upper and lower limits of the frequency which depend upon the minimum and maximum values of HL. As seen already, HL is a register pair, i.e. it can hold any number between 0 and 65535.

Rearranging the equation for HL, to represent frequency in terms of HL, we obtain

$\text{Frequency} = 437500/(HL+30.125)$

For a minimum value, HL=0, we have

$\text{Frequency} = 437500/30.125$

$= 14522.8$ Hz

For a maximum value, HL=65535, we get

$\text{Frequency} = 437500/(65535+30.125)$

$= 6.67$ Hz

Though these are the theoretical limits of the frequency, the 10Hz to 10kHz range would be a more accurate and practical one. The square waves produced in this range have a typical rise time of less than 1 microsecond.

An example

Let's consider a practical example. Suppose, it is required to produce a frequency of 500 Hz for a duration of six seconds:

$DE = \text{Frequency} \times \text{Duration}$

$= 500 \times 6$

$= 3000$

$HL = (437500/\text{Frequency}) - 30.125$

$= (437500/500) - 30.125$

$= 844.875$

Always **round down** the value of HL obtained in the step above, so that

HL=844

Having set these two registers, we can call the Beeper routine to produce the square-wave signal.

The values of HL and DE are set automatically by the BASIC program which utilises the same formulae to compute the values and utilises the POKE statement to store the values in memory.

The analogy of my small machine language routine with BASIC is given in the Table below. This routine only acts as a link between the BASIC program and the ROM routine (Beeper).

TABLE
Analogy of the Machine Language with BASIC

Address	Hex Dump	Z80 Assembler	Analogous BASIC Program
32000	21 00 00	LD HL,0 (see text)	LET HL=0
32003	11 00 00	LD DE,0 (see text)	LET DE=0
32006	CD B5 03	CALL 949d (BEEPER)	GOSUB BEEPER (Address 949d)
32009	C9	RET	RETURN

Here's a brief summary of the BASIC program for your understanding:

Line 80 reserves memory to store the small machine code program beginning at address 32000.

Lines 90-110 store the machine code into memory, the code is transferred from the DATA statement in line 130 to the memory address from 32000 to 32009.

Lines 150-290 display the title and accept the input from the user – making sure that the inputs are within the range.

Lines 360 and 370 compute the values of registers HL and DE.

Lines 380-450 break the values of HL and DE in HIGH and LOW parts for their subsequent storage in memory.

Lines 490-540 display the initial parameters set by the user, including a flashing indication when the signal is available.

Fig. 2 shows how the sound from Spectrum can be amplified to hear the tones being generated. The output from its MIC socket can also be fed to a single-stage transistor amplifier for use of these signals in other circuits.

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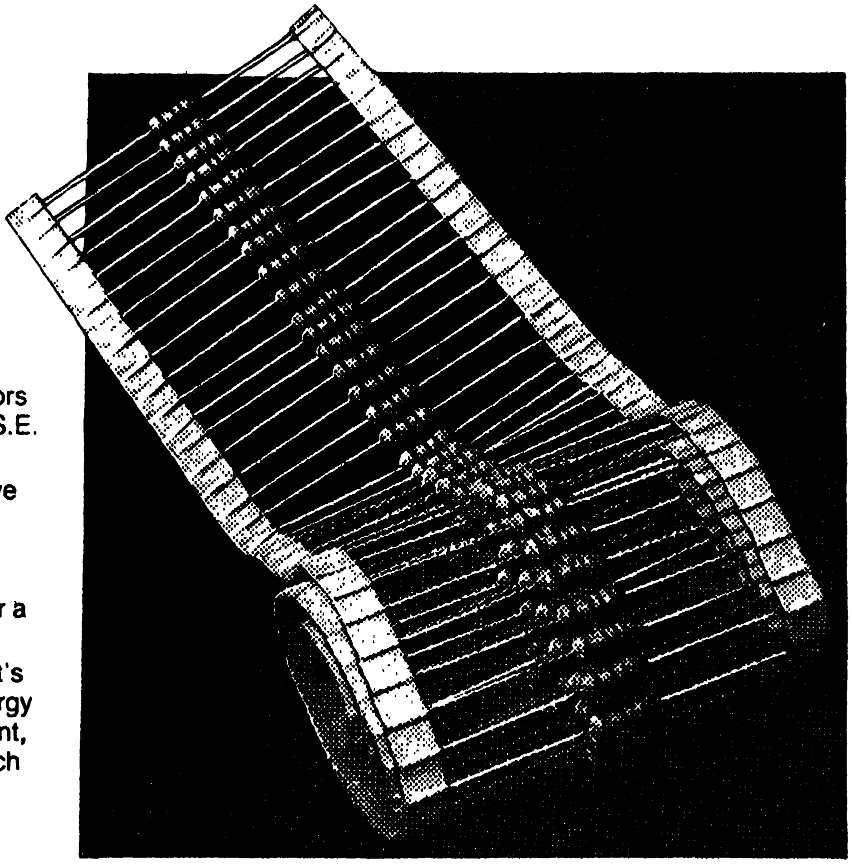

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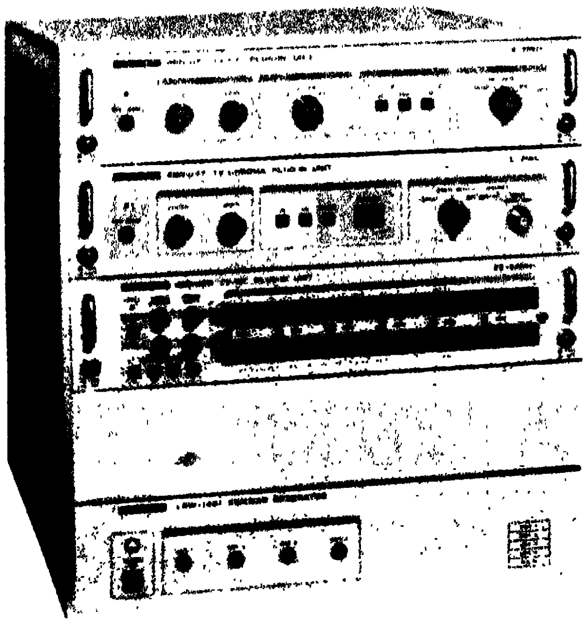

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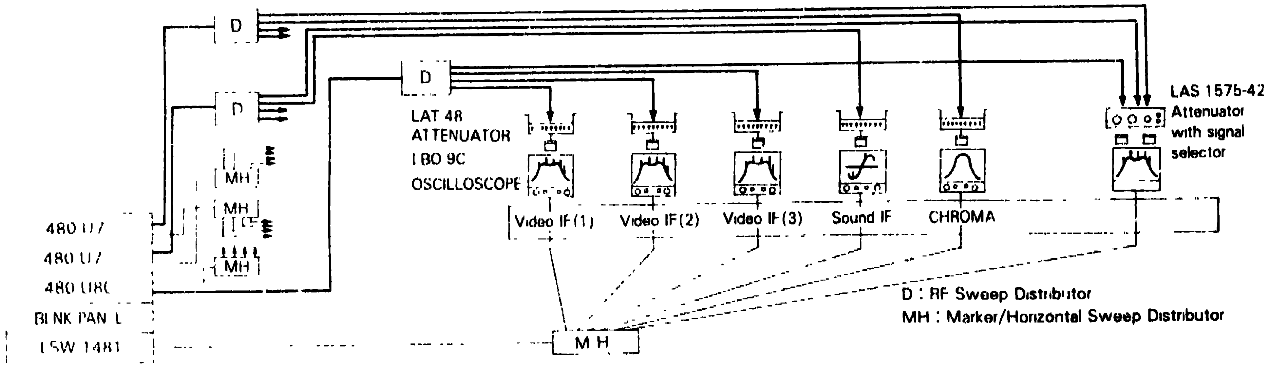

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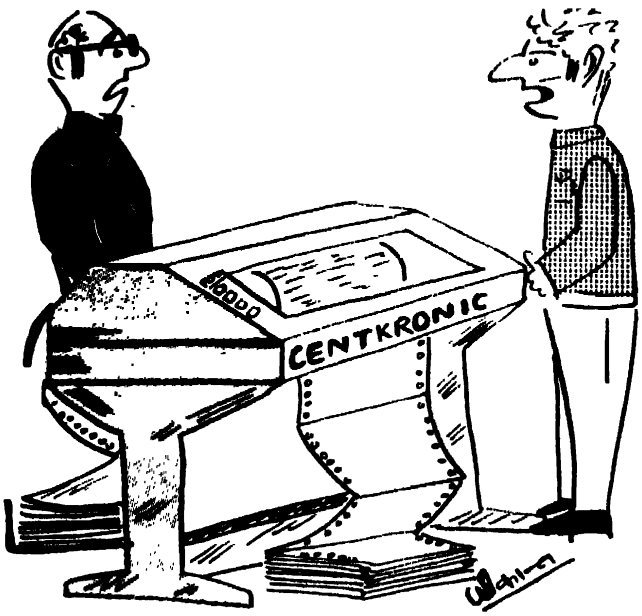

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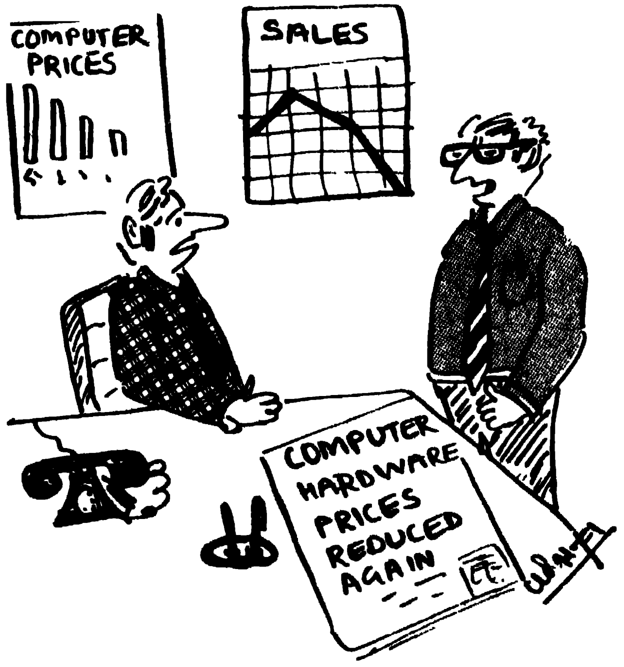
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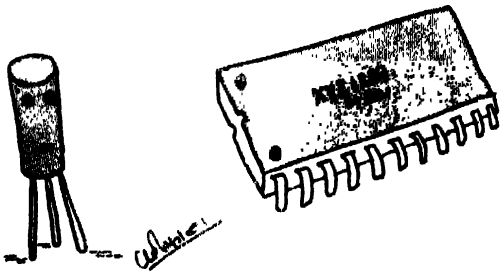

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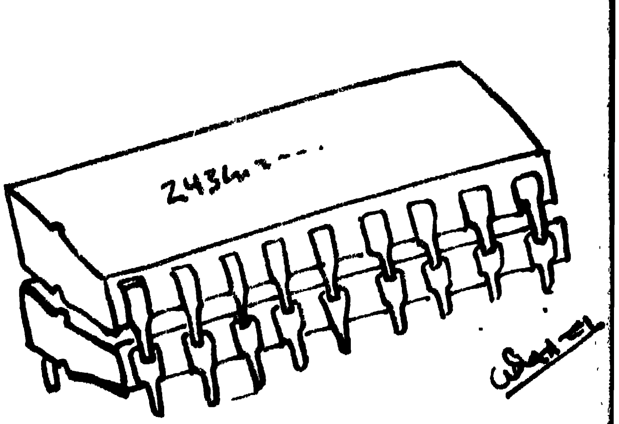

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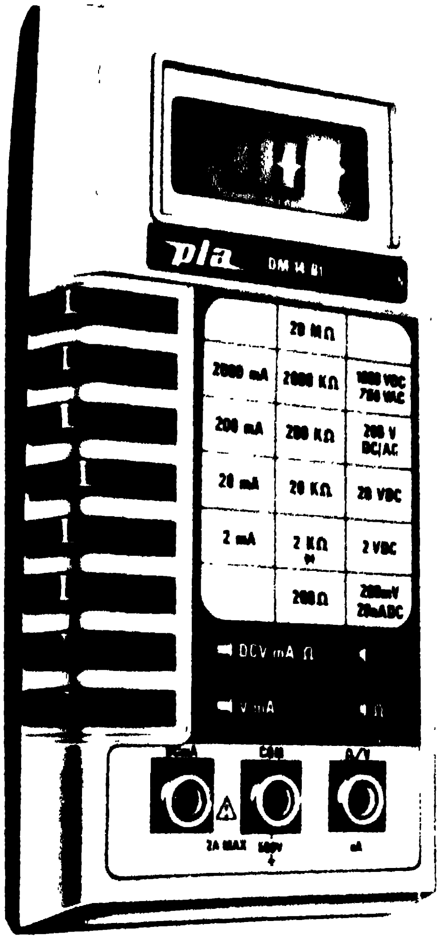

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An Introduction to Compilers

Part I

Suresh K. Basandra

The subject matter of compiler construction can be considered as a form of language translation. The phrase 'language translation' suggests the existence of several languages and, also, the notion of translation. By translation we mean a mapping of sentences of a given language to sentences of another given language.

A necessary aspect of translation is that the mapping preserves the meaning of the sentence to be translated. Since this is a very broad constraint, it should be evident that, in general, translation is a one-to-many mapping.

As we are interested in solving problems by using computers, the act of translation can be imperatively expressed as: Take an arbitrary sentence of some given language, analyse it and, if possible, synthesise a sentence of another given language so that it completely conveys the meaning of the initial sentence.

To realise this, however, several major problems have to be carefully considered: What is a language? What do we mean by an analysis of statements in a language? How do we ascribe a meaning to a sentence in any language? In any given language, how do we synthesise sentences which will have a given meaning? If many sentences can be ascribed the same meaning, how do we choose amongst them?

The most common languages we know of are the natural languages such as English. Our understanding of such languages is rather loose and cannot be succinctly expressed. This is not at all surprising, for such languages are usually very vast. Consequently, the problem of translation between such languages has mammoth proportions. Fortunately, for the present, our interests lie in a very specific set of languages, the so-called 'programming languages'.

Programming languages provide a precise and unambiguous means for communication between man and machine. Amongst such languages, we distinguish between those which are more suited for problem-solving by man from those which are suited for direct interpretation by a machine. In this article, we will be concerned with the translators (agents which perform translation) which translate sentences from languages in the former class to sentences of languages in the latter class. Compilers are such translators.

Compilers and translators

A 'translator' is a program that takes as input a program written in one programming language (the source language) and produces as output a program in another language (the object or target language). If the source language is a high-level language such as FORTRAN, PL/I or COBOL, and the object language is a low-level language such as an assembly language or machine language, then such a translator is called a 'compiler'.

Programs written in source languages are called 'source programs'. On the other hand, object languages are usually suited for machine interpretation. Programs expressed in object languages are called 'object programs'. To translate a source program, the compiler must analyse it thoroughly and synthesise an equivalent object program.

The task performed by a compiler is called 'compilation'. During compilation, the process of source program analysis yields a variety of information about source programs. This information has to be preserved by the compiler for it to produce an equivalent object program. Various data structures, such as tables, lists, trees, etc are employed by the compiler to preserve this information. The construction of an equivalent object program is directed by the information

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Mr Basandra, an M. Tech in Computer Technology, unravels the system of 'compilers' and various other terms like 'translators' and 'interpreters' that the readers may have heard and wondered as to their actual meaning.

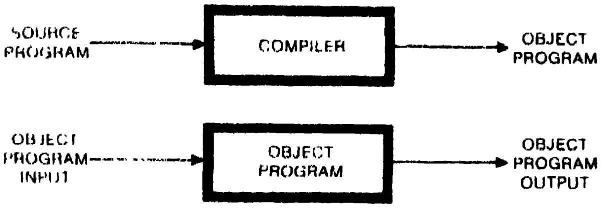

Fig. 1: Compilation and execution.

preserved in these data structures. All the actions performed by a compiler are said to occur at 'compile-time'.

Executing a program written in a high-level programming language is basically a two-step process, as illustrated in Fig. 1. The source program must first be compiled, i.e. translated into the object program. Then the resulting object program is loaded into memory and executed.

Other translators

Certain translators transform a programming language into a simplified language, called 'intermediate code', which can be directly executed using a program called an 'interpreter'. We may think of the intermediate code as the machine language of an abstract computer designed to execute the source code. For example, SNOBOL is often interpreted, the intermediate code being a language called 'polish postfix notation'.

In some cases, the source language itself can be the intermediate language. For example, most 'command languages', such as JCL, in which one communicates directly with the operating system, are interpreted with no prior translation at all.

Interpreters are often smaller than compilers and facilitate the implementation of complex programming language constructs. However, the main disadvantage of interpreters is that the execution time of an interpreted program is usually more than that of a corresponding compiled object program.

There are several other important types of translators, besides compilers. If the source language is assembly language and the target language is machine language, then the translator is called an 'assembler'.

The term 'preprocessor' is sometimes used for translators that take programs in a high-level language into equivalent programs in another high-level language. For example, there are many FORTRAN preprocessors that map 'structured' versions of FORTRAN into conventional FORTRAN.

Programming languages

Here it is intended to define a programming language formally. This has to be done because, intuitively speaking, a compiler specifies a relationship between source programs and object programs. It does this for all source programs, and hence compilation is really a relationship between two languages. In other words, a compiler is not concerned with any specific set of source programs but all programs that can be written in the source language.

A programming language is a notation with which people can communicate algorithms to computers and to one another.

Syntax

A program in any language can be viewed as a string of characters chosen from some set, or 'alphabet', of characters. But how do we prescribe which strings of characters represent valid programs? The rules that tell us whether a string is a valid program or not are called the 'syntax' of the language.

It is often almost impossible to state concisely and precisely what strings are valid programs, just as it is hard to state which sentences of English are proper and which are not.

Semantics

Once we know that we have a valid program, how do we specify what the program does? It is essential to know what a program means if we are to compile it faithfully into a machine language program that does what the programmer expects. The rules that give meaning to programs are called the 'semantics' of the programming language.

The semantics of a programming language are much harder to specify than its syntax. No completely satisfactory means for specifying semantics in a way that helps construct a correct compiler for the language has been found.

The hierarchical structure of programming languages

A programming language is a notation for specifying a sequence of operations to be carried out on data objects. Both the data objects and the operations can be grouped into a hierarchy that looks like the tree of Fig. 2. Not all languages have every one of these features, and some languages such as ALGOL 68, permit statements to be in expressions. Nevertheless, the units in this hierarchy are so common that they should be familiar to all.

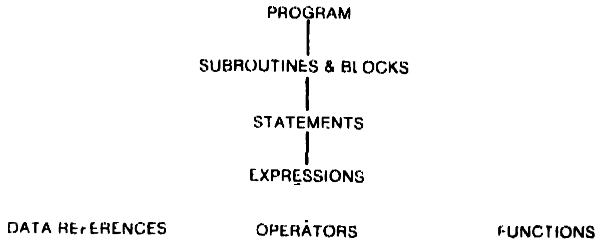

Fig. 2: Hierarchy of program elements.

At the top of the hierarchy is the program itself. The program is the basic execution unit. Next comes an entity that can be compiled but not necessarily executed—the subroutine or block. These are units which may have their own data (local names).

Subroutines differ from blocks by being callable from other portions of a program. Both subroutines and blocks are composed of statements. In turn, statements are fashioned from expressions which are made up of operators, function calls, and references to data.

The structure of a compiler

The compiler takes as input a source program and produces as output an equivalent sequence of machine instructions. This process is so complex that it is not reasonable, either from a logical point of view or from an implementation point of view, to consider the compilation process as occurring in one single step. For this reason, it is customary to partition the compilation process into a series of subprocesses called 'phases' as shown in Fig. 3. A phase is a logically cohesive operation that takes as input one representation of the source program and produces as output another representation.

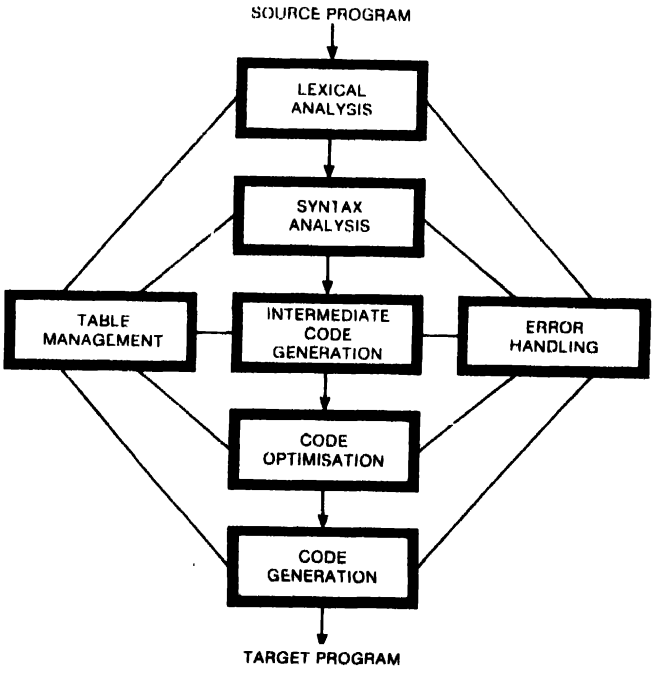

Fig. 3: Phases of a compiler.

As input to a compiler, the source program is only a string of characters. From this linear representation of the program, the process of source program analysis should detect the structure and meaning of the program.

This is very similar to the actions involved in finding constituent phrases in a sentence in English, in which case we do so by making use of the English grammar. In order to understand an English sentence, we must first know the meaning of various words used in it; grouping the words into phrases allows us to ascribe meanings to these phrases; and finally, combining the meanings of the phrases according to the grammatical structure of the sentence leads to an understanding of the sentence.

From the above analogy, it is reasonable to assume that the source language has a grammar which defines acceptable grammatical structures for source programs. In order to analyse the structure of a source program, we have to formulate a strategy for recognising its constituent sub-structures. Also, we have to detect the methods by means of which these sub-structures are bound together to form a whole source program.

Looking at the analogy of grammatical analysis of English sentences again, we note that we recognise words first and then we search for the phrases. The first phase consists of the analysis of the string of characters in the source program so as to form meaningful primitives (analogous to words and punctuation marks in an English sentence).

The first phase, called the 'lexical analyser' or 'scanner' separates characters of the source language into groups that logically belong together; these groups are called 'lexemes' or 'tokens'. The usual tokens are keywords such as D0 or IF, identifiers (the equivalent of 'names' in programming languages) such as X or NUM, operator symbols such as '·', ' ', '=' or '+', and punctuation symbols such as parentheses or commas.

The output of the lexical analyser is a stream of tokens which is passed to the next phase. The tokens in this stream can be represented by codes which we may regard as integers. Thus, D0 might be represented by 1, + by 2, and 'identifier' by 3. In the case of a token like identifier, a second quantity that indicates which of those identifiers used by the program is represented by this instance of token identifier is passed along with the integer code for identifier.

The task of this first phase is quite simple and straightforward. Subsequent to this phase of analysis, a source program may be viewed as a sequence of tokens.

Following lexical analysis is the task of recognising grammatical phrases in a source program. This is a more complicated task: sequences of lexemes have to be grouped together to form simple phrases of the source language; these simple phrases are used to form more complex ones and, ultimately, source programs.

All these actions are the substance of 'syntax analysis', the term usually ascribed to this second phase in the analysis of source programs. The syntax analyser groups tokens together into syntactic structures. For example, the three tokens representing A+B might be grouped into a syntactic structure called an 'expression'. Expressions might further be combined to form statements.

Often, the syntactic structure can be regarded as a tree whose leaves are the tokens. The interior nodes of the tree represent strings of tokens that logically belong together.

The 'intermediate code generator' uses the structure produced by the syntax analyser to create a stream of simple instructions. Many styles of intermediate codes are possible. One common style uses instructions with one operator and a small number of operands. These instructions can be viewed as simple macros. The primary difference between intermediate code and assembly code is that the intermediate code need not specify the registers to be used for each operation.

'Code optimisation' is an optional phase designed to improve the intermediate code so that the ultimate object program runs faster and/or takes less space. Its output is another intermediate code program that does the same job as the original, but perhaps in a way that saves time and/or space.

The final phase, known as 'code generation', produces the object code by deciding on the memory locations for data, selecting codes to access each datum, and selecting the registers in which each computation is to be done. Designing a code generator that produces truly efficient object programs is one of the most difficult parts of compiler design, both practically and theoretically.

The 'table-management' or 'book-keeping' portion of the compiler keeps track of the names used by the program and records essential information about each, such as its type (integer, real etc). The data structure used to record this information is called a 'symbol table'.

The 'error handler' is invoked when a flow in the source program is detected. It must warn the programmer by issuing a diagnostic, and adjust the information being passed from phase to phase so that each phase can proceed.

It is desirable that compilation be completed on flawed programs, at least through the syntax-analysis phase, so that as many errors as possible can be detected in one compilation. Both the table-management and error handling routines interact with all phases of the compiler.

Passes

In an implementation of a compiler, portions of one or more phases are combined into a module called a 'pass'. A pass reads the source program or the output of the previous pass, makes the transformation specified by its phases, and writes output into an intermediate file which may then be read by a subsequent pass. If several phases are grouped into one pass, then the operation of the phases may be interleaved, with control alternating among several phases.

The number of passes, and the grouping of phases into passes, are usually dictated by a variety of considerations germane to a particular language and machine rather than by any mathematical optimality criterion. The structure of the source language has a strong effect on the number of passes.

Certain languages require at least two passes to generate code easily. For example, languages such as PL/I or ALGOL 68 allow the declaration of a name to occur after uses of that name. Code for expressions containing such a name cannot be generated conveniently until the declaration has been seen.

The environment in which the compiler must operate can also affect the number of passes. A multi-pass compiler can be made to use less space than a single-pass compiler, since the space occupied by the compiler program for one pass can be reused by the following pass.

A multi-pass compiler is, of course, slower than a single-pass compiler, because each pass reads and writes an intermediate file. Thus, compilers running on computers with small memory would normally use several passes while, on a computer with a large random access memory, a compiler with fewer passes would be possible.

Reducing the number of passes

Since each phase is a transformation on a stream of data representing an intermediate form of the source program, it may be wondered how several phases can be combined into one pass without the reading and writing of intermediate files. In some cases one pass produces its output with little or no memory of prior inputs. Lexical analysis is typical. In this situation, a small buffer serves as the interface between passes. In other cases, we may merge phases into one pass by means of a technique known as 'backpatching'. In general terms, if the output of a phase cannot be determined without looking at the remainder of the phase's input, the phase can generate output with 'slots' which can be filled in later, after more of the input is read.

While it is not possible to deal with backpatching in detail, an example from assemblers will serve as a paradigm. An assembler might have a statement like

```
GOTO    L
```

which precedes a statement with label L. A two-pass assembler uses its first pass to enter into its symbol table a list of all identifiers (statement labels and data names) together with the machine address (relative to the beginning of the program), to which these identifiers correspond. Then a second pass replaces mnemonic operation codes, such as GOTO by their machine language equivalent, and replaces uses of identifiers by their machine address.

A one-pass assembler, on the other hand, could generate a skeleton of the GOTO machine instruction the first time it saw GOTO L. It could then append the machine address for this instruction to a list of instructions to be backpatched once the machine address for L is determined. For example, when the assembler encounters a statement such as

```
L:ADD  X
```

it scans the list of statements referring to L and places the machine address for statement L : ADD X in the address field of each such instruction. Subsequent assembly instructions referring to L can have the value for L substituted immediately.

In a compiler, most of the backpatching that needs to be done is done over relatively short distances. Labels, for example normally need to be backpatched as above only with one procedure or subroutine. The distance over which backpatching occurs is important since the code to be backpatched must remain accessible until backpatching is complete. Even though the object program may fit in memory when it is produced, intermediate forms of the source program may be too big to fit in memory all at once, especially as a substantial portion of memory may be occupied by the compiler program itself.

(To be continued)

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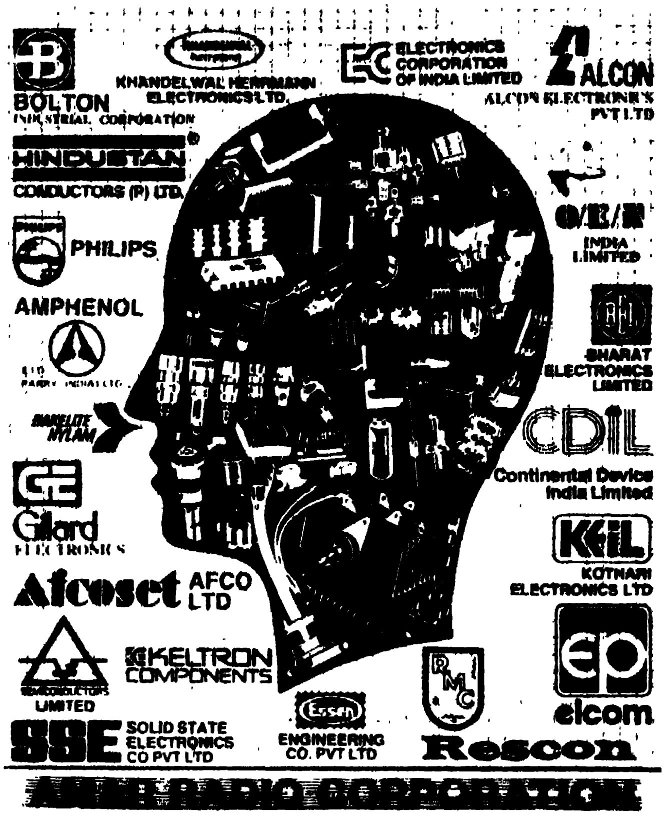
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Comparative Study of Computer Languages

Input Output Statements(4)

Part XIII

R. Ramaswamy

As in the case of FORTRAN, COBOL, BASIC and PL/1, we also have three ways of entering data into a PASCAL program. These are:

1. Entering data through the console.
2. Entering data in the program itself.
3. Entering data in the program by reading a file.

Here we will consider the first two methods and study the third later.

Input statements for entering data through the console

There are two input statements, namely, READ and READLN. The READ statement gets the data given in a stream fashion, while the READLN statement gets the data given on a line by line basis. The general form of the READ statement is

```
READ(list);
```

And the general form of the READLN statement is

```
READLN(list);
```

Suppose we write the READ statement as follows:

```
READ(A,B);
READ(C,D);
```

In the above case the values of A, B, C and D can be keyed in one line or two lines or three lines or even four lines, as shown below

```
34.5 65.7 78.9 87.0          (One line)

34.5 65.7     }
78.9 87.0     }              (Two lines)

34.5 65.7     }
78.9          }              (Three lines)
87.0          }

34.5          }
65.7          }
78.9          }              (Four lines)
87.0          }
```

The first READ statement reads the first two values in the stream. The second READ statement reads the next two values in the stream irrespective of the number of data in each line.

Suppose we give READLN statements as shown below:

```
READLN(A,B);
READLN(C,D);
```

In the above case the values of A and B must be keyed in the first line and the values of C and D must be keyed in the second line. If the values of all the variables are keyed in the same line, the computer will give error message. Both the READ and the READLN statements give instructions to the computer to get the data for the program through the console. The READ and the READLN statements in PASCAL are analogous to the READ statement in FORTRAN, INPUT statement in BASIC, ACCEPT statement in COBOL and GET LIST statement in PL/1.

Output statements for printing the result on paper

There are two output statements to print the result on paper. They are the WRITE and the WRITELN statements. The general form of the WRITE and the WRITELN statements are

```
WRITE(list),
WRITELN(list),
```

The WRITE statement will cause the printing of the values of the variables in the list continuously. If the first line is full the printing will be continued in the second line until the list is exhausted. The WRITELN statement will cause the printing of the values of the variables in the first line. If there are more variables than could be accommodated in the first line, the same will not be printed. Suppose one writes

```
WRITE(A,B),
WRITE(C,D),
```

The values of A, B, C and D will be printed in the same line.

Now if one writes

```
WRITELN(A,B),
WRITELN(C,D);
```

the values of A and B will be printed in the first line and the values of C and D will be printed in the second line. A string in the WRITE or the WRITELN statement will be printed as it is. Numeric quantities will be printed in the exponent notation. Suppose the basic pay of a person is 2500.00 and if one writes a statement

```
WRITELN ('BASICPAY=', BASICPAY),
```

the computer will print the result as

```
BASIC PAY = 2.500000E+03
```

Obviously, the above form is not meaningful. The numeric value must be given in floating point notation. For this purpose we have to give formats for the output.

Formatting the output

When we give a simple WRITE statement or a WRITELN statement with the arguments list inside the parantheses, the computer will print the result in a pre-defined format. But when we want to print the result as per our layout, we have to give necessary specifications explicitly. Such specifications are called format specifications. The field width for each variable can be specified as an integer constant or an expression yielding an integer value immediately after the variable followed by a colon mark. Numbers as well as characters will be printed right justified in the given field. For example, if one writes

```
WRITELN(A:10);
```

and the value of A is 46, the value will be printed in the ninth and the tenth columns, leaving the preceding eight columns blank. If A has been defined as a character variable whose value is 'K', then the letter K will be printed in the tenth column leaving the preceding nine columns blank. If A had been defined as a BOOLEAN variable whose value is TRUE, then the value TRUE will be printed in the columns 7 to 10, leaving the first six columns blank.

The point is that the printing is done always right justified in the given field width, whether the value is a number or a character or a logical constant. If the value of A is 56.78, we can give a specification to print the two digits to the right of the decimal point within a total field width of 10 as follows:

```
WRITELN(A:10:2),
```

The number will be printed in the right justified position in the field width of 10 as

```
bbbbb56.78
```

If you have more than one variable in the WRITELN list, the field specification is given separately for each of the variables. For example, one can write

```
WRITELN (A:10:2, B:7:3, C:5),
```

In the above case, A will be printed right justified in the first ten columns, B will be printed right justified in the second seven columns and C will be printed right justified in the third five columns. There are no other formatting specifications in PASCAL. We find that formatting is the simplest in PASCAL as compared to other languages.

A WRITELN statement without any argument list simply causes the computer to skip to the next line and this is used for giving vertical spacing between lines.

Input statements for entering data in the program

The READ and the READLN statements require the data to be entered through the console. PASCAL has another provision to initialise the data in the program itself. This is done by a declaration statement called the CONSTANT declaration statement. Its general form is as follows:

```
CONST   variable-1 = value,
        variable-2 = value;
        variable-3 = value,
```

The value associated with the identifier is given as an equation. The value of the identifier must not change in the program by any statement. This means that the variable whose value is declared to be a constant must not change during the program execution.

The reserved word CONST must appear only once, though the values of any number of variables can be defined. The constant values assigned may be either numeric or character or Boolean or even a string. Constant declarations must be made ahead of the program. The following are examples of valid CONSTANT declarations:

```
CONST    PI = 3 14159
         TWO  2
         BLANK
         ALWAYS  TRUE
         EMPNAME   BALACHANDRAN
         ALPHA   A
```

At the end of the value the punctuation semicolon is a must In PASCAL, the variables which have been initialised under CONSTANT declaration must not occur on the left-hand side of any assignment statement within the program This means that these variables cannot be assigned any other value in that particular program This statement can be used only when constant values are to be initialised and not when changing data values are to be initialised

Summary of the input statements

Language	General form of statements for entering data through console	General form of statements for entering data in the program
FORTRAN	READ(m n) list	DATA list values
COBOL	ACCEPT variable	77 variable PIC VALUE
BASIC	INPUT list	READ list
PL/I	GET LIST(list)	DCL (list) type STATIC INIT (values)
PASCAL	READ(list) READLN(list)	CONST variable value (only for constant data values)

Thus, we see that all the languages provide facilities for entering data into the program either through the console or entering the data in the program itself The way of coding the statements are different in the different languages

Summary of the output statements

Language	General form of output statements for printing the result on paper	Remarks about formats
FORTRAN	WRITE(m n) list	A separate format statement must be given
COBOL	DISPLAY list	Formats must be given separately
BASIC	PRINT list PRINT USING formats or format variable, list	Formats can be given either in the PRINT statement or separately
PL/I	PUT LIST(list) PUT EDIT(list) (formats or R (format label))	Formats can be given either in the PUT LIST statement or separately
PASCAL	WRITE(list), WRITELN(list),	Formats must be given in the WRITE or the WRITELN statement

This form of output statements will print the result on paper and also display the result on the screen

Self-testing assignment

You have two variables A and B whose values are 23 7 and 44 respectively Write the input and the output statements in the proper sequence (a) to enter the data through and console and print them on paper, and (b) to enter the data in the program itself and print them on paper in all the five languages Give formats wherever necessary

FORTRAN

```
Inputting through console        Inputting through the program
and outputting on paper           and outputting on paper

    INTEGER B                        INTEGER B
    READ(1 10) A B                   DATA A B 23 7 44
10  FORMAT(F5 1 I3)                  WRITE(2 12)A B
    WRITE(2 12)A B              1    FORMAT (1X F5 1 I5)
12  FORMAT(1X F5 1 I5)
```

COBOL

```
77  A PIC 999V9                  77  A PIC 999V9 VALUE 23 7
77  B PIC 999                    77  B PIC 999 VALUE 44
77  C PIC ZZZ9                   77  C PIC ZZZ9
77  D PIC ZZZZZ                  77  D PIC ZZZZZ
    ACCEPT A                         MOVE A TO C
    ACCEPT B                         MOVE B TO D
    MOVE A TO C                      DISPLAY C  D
    MOVE B TO D
    DISPLAY C  D
```

BASIC

```
INPUT A  B                     READ A  B
PRINT USING  ### # ####        DATA 23 7  44
 A B                           PRINT USING  ### # ####
                                A B
```

PL/I

```
DCL A FLOAT BINARY             DCL A FLOAT BINARY
     B FIXED BINARY             STATIC INIT (23 7)
GET LIST (A  B)                 B FIXED BINARY
PUT SKIP EDIT(A  B)             STATIC INIT(44)
 (F(5 1) F(5))                 PUT SKIP EDIT(A B)
                                (F(5 1) F(5))
```

PASCAL

```
VAR A REAL  B INTEGER   CONST A   23 7  B   44
READLN(A B)             WRITELN(A 5 1  B 5)
WRITELN(A 5 1  B 5)
```

It may be noticed that only in BASIC no declarations are made about the variable types In FORTRAN declaration is made only for the variable B, since the type has to over-ride the predefined convention There is no declaration for A since its value is according to the predefined convention

In all the above cases the result will be printed in the same way as shown below

```
23 7   44
```

What about string data items?

Only a string of maximum four characters length can be stored in a single FORTRAN variable In PASCAL, only one character can be stored in a variable and the variable is called the character variable Strings can be read assigned manipulated and printed with facility only in the three languages, COBOL, PL/1 and BASIC

Another self-testing assignment

A string constant 'KRISHNAN' is to be stored Write the input and the output statements in the proper sequence (a) to enter the data through the console and print them on paper, and (b) to enter the data in the program itself and print them on paper in all the five languages Give the declaration statements and formats wherever necessary

FORTRAN

Inputting through console and outputting on paper — **Inputting through the program and outputting on paper**

```
   READ(1 10) A B               DATA A B KRIS
10 FORMAT(2A4)                  HNAN
   WRITE(2 12)A B               WRITE(2 12) A B
12 FORMAT(1X 2A4)            12 FORMAT(1X 2A4)
```

COBOL

```
77 A PIC A(8)                   A PIC A(8) VALUE
   ACCEPT A                     KRISHNAN
   DISPLAY A                    DISPLAY A
```

BASIC

```
INPUT A$                 READ A$
PRINT A$                 DATA KRISHNAN
                         PRINT A$
```

PL/1

```
DCL A CHARACTER(8)       DCL A CHARACTER(8)
GET LIST(A)              STATIC INIT (KRISHNAN)
PUT LIST(A)              PUT LIST(A)
```

PASCAL

```
VAR A B C D E F G H CHAR    CONST A  KRISHNAN
READLN(A B C D E F G H)     WRITELN(A)
WRITELN(A B C D E F G H)
```

In FORTRAN we have stored the name KRISHNAN in two variables A and B since one variable can read and write only four characters The variables are read and written in the A format There are no declaration statements for that in FORTRAN

In COBOL there is no problem, since a variable which is declared as belonging to alphabetic data type can store long strings

In BASIC, we have a different way of coding string variables A dollar sign at the end of the variable indicates that it is a string variable and it can store long strings

In PL 1, a string variable is declared as CHARACTER with its length specified in the bracket

In PASCAL, a single variable can read and write only one character Since the string data has eight characters, eight variables are declared Then they are read and written When a PASCAL variable is declared as a CONSTANT with a value, it can store a string So we have given a CONSTANT [illegible] giving the value of the variable A equal to the string data Then the constant variable is given in the WRITELN statement

When we come to array structure for data we will see how the string data can be more efficiently handled in FORTRAN and PASCAL

Some points to remember

The input to the computer is raw data The output from the computer is processed data The computer makes use of the program and converts the raw data into a meaningful data The computer is simply a data converter and we may call it a data processing machine

Remember that all processings are done completely automatically by using the stored instructions or the program That is, the computer can store both the program and the data in its memory Once it is started it can do all the operations on the data as per the program of instructions completely automatically without any human intervention at any stage of operation and output the result

It is this automaticity coupled with the fantastic speed that has made the computer so versatile The computer is a superb marvel of modern technology It is progressing by leaps and bounds and we can expect many more marvels in the years to come Man is constantly generating new knowledge and one has to be a learner throughout life!

(To be continued)

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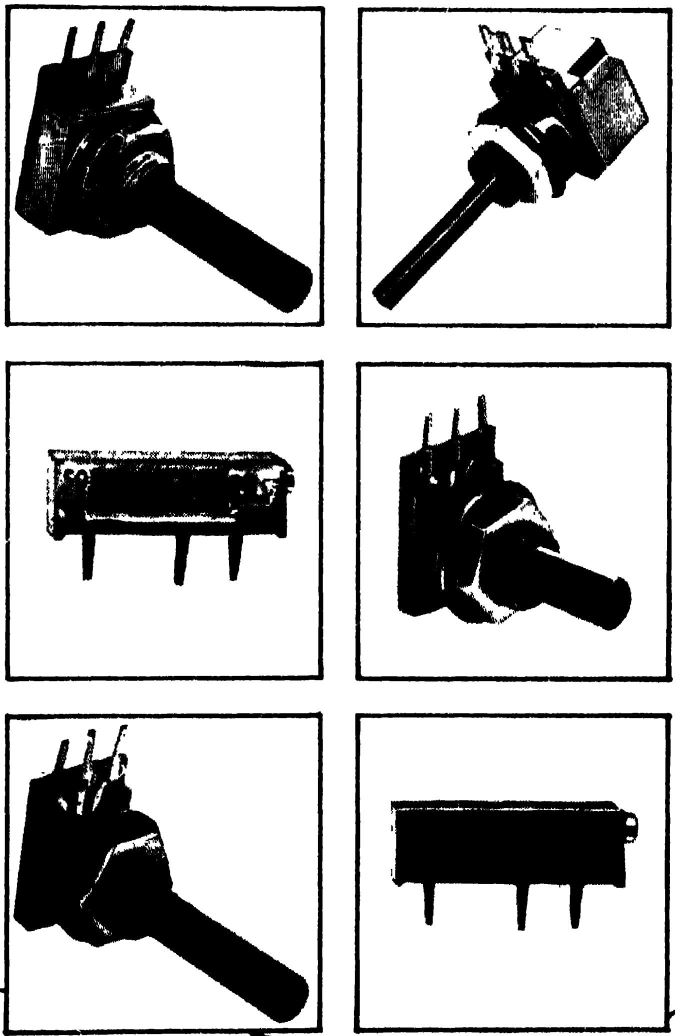

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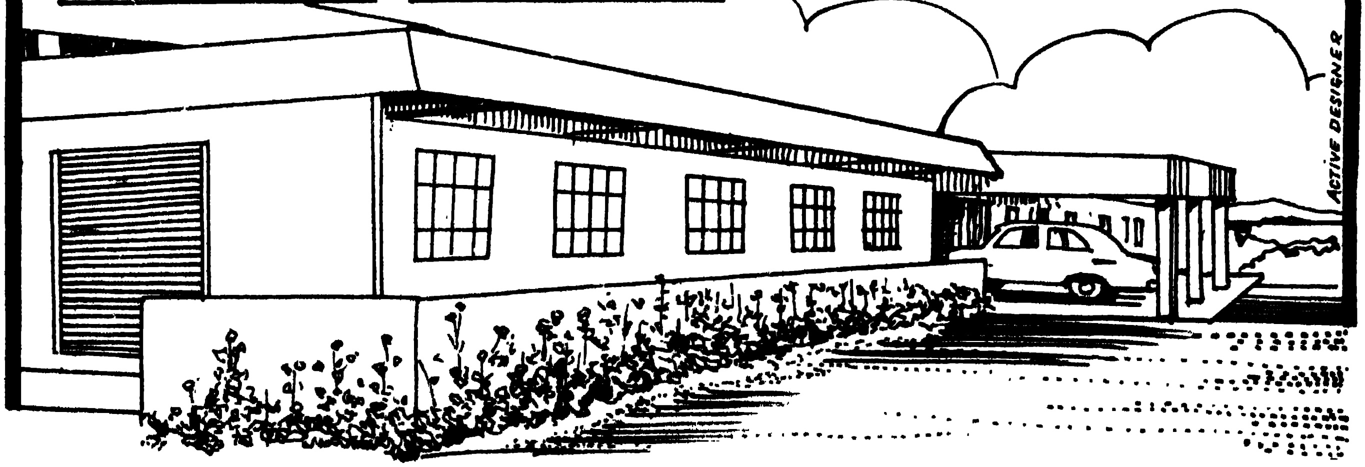


Traffic Light Control System

Ravi Kant Taxali

Traffic density on roads in big cities like Delhi, Bombay, Calcutta, Madras and Hyderabad has become so high that it requires a lot of planning for smooth flow of the traffic on the roads. Therefore, the traffic lights have been installed at almost all major traffic crossings in these cities.

Have you ever noticed the actual sequence of traffic lights at some busy crossing? Well, let us have a look at a traffic crossing and write down the sequence. Fig. 1 shows two roads—one in North-South (NS) direction and the other in East-West (EW) direction. In this figure we have not shown the lights at the South and East ends. Lights at the South and East ends are similar to lights at North and West ends respectively. So, when the traffic for South to North is open green lamp no. 3 is on, the North to South traffic will also be open. In other words, the lights at the two opposite ends are connected in parallel.

The typical sequence of lights and the duration of each step, as observed at one major traffic crossing in New Delhi, is given in Table 1. After taking a look at Table 1, one will realise that the present-day traffic control is not so simple.

The other part of the traffic control, which many readers may not be aware of, is also equally important for the smooth flow of the traffic on major roads, where one finds a road crossing after every hundred metres or so. This is called

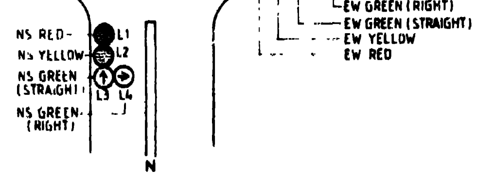


Fig. 1: Typical traffic light system on the road crossing.

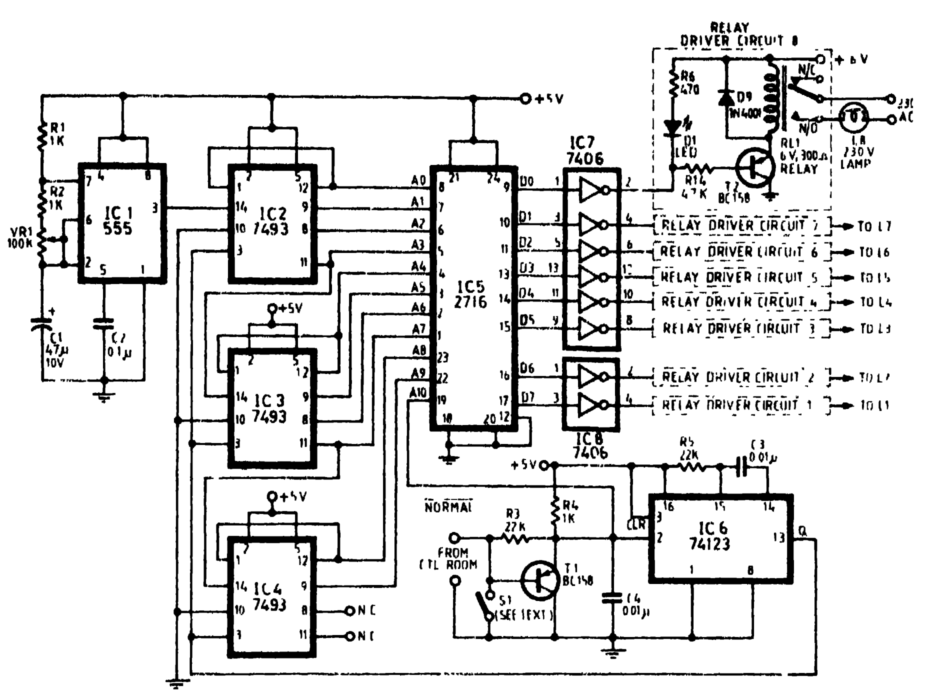


Fig. 2: Circuit diagram for traffic light control system.

PARTS LIST

Semiconductors:	
IC1	— NE555 timer
IC2-IC4	— 7493/74LS93 divide-by-sixteen counter
IC5	— TMS2516/2716 EPROM
IC6	— 74123/74LS123 dual multivibrator
IC7, IC8	— 7406 hex inverter
T1—T9	— BC158 pnp transistor
D1—D8	— 5mm red LED
D9—D20	— 1N4001, 1 amp rectifier diode
***Resistors** [all 1/4 watt, ±5% carbon]:*	
R1, R2, R4	— 1-kilohm
R3, R5	— 22-kilohm
R6—R13	— 470-ohm
R14—R21	— 4.7-kilohm
VR1	— 100k linear potentiometer
Capacitors:	
C1	4.7μF, 16V electrolytic
C2, C6—C9	0.1μF, 12V ceramic
C3, C4	0.01μF, 12V ceramic
C5	4700μF, 25V electrolytic
Miscellaneous:	
S1	SPDT switch
RL1—RL8	6-volt, 300-ohm relay
L1—L8	230V, 100-watt lamp
	PCB, IC sockets, LED holder, Lamp reflecter, cables, enclosure, hardware etc.

'synchronisation' of various traffic lights through remote control. Here, the timings of various traffic lights at different crossings on one major road are adjusted in such a way that once the traffic finds 'green' light on the major (main) road, it should find green light at the next crossing too, if the traffic is moving at the recommended speed. The traffic control for the outer circle of Connaught Place of New Delhi is one such example.

The traffic light control system should also have the facility to operate in the so-called 'Hold Mode'. In this mode, the normal sequence of lights is discontinued and only yellow (or red) lights keep blinking to caution the traffic. The hold mode is normally used during late night hours or early morning hours, or when the traffic is to be controlled manually.

Now let us study a simple traffic light control circuit which uses a minimum of components. The circuit will be able to perform all the above-mentioned operations.

The circuit

The circuit for the traffic light control is given in Fig. 2. The suitable power supply for the system is given in Fig. 3.

The most familiar clock generator IC 555 is used in astable mode to generate the basic clock. The clock frequency can be adjusted by varying potentiometer VR1.

The circuit uses three 4-bit binary counter ICs, 7493 (74LS93) which are connected in cascade mode to generate the 'address' for the 2716 EPROM. The four outputs (O/Ps) of the first two counters (IC2 and IC3) and two O/Ps of the third counter (IC4) are used. This makes 10 address lines, which gives two, i.e. 1024 addresses (locations/combinations). So, if we want the traffic light cycle (step 1 through step 10) to take 128 seconds, the clock should be adjusted to 1024/128, i.e. 8 Hz or 0.125 seconds. Thus, we can control the traffic light with a resolution of 0.125 seconds.

Pin numbers 18 (chip select) and 20 (output enable) of the 2716 (IC5) are grounded. So, the 2716 chip is always selected. Now, depending on the address present at the address lines (A0 to A10), the 2716 will give out the data, which is already stored (programmed) at that address.

TABLE 1

Step	Lamp 1 NS Red	Lamp 2 NS Yel	Lamp 3 NS Grn	Lamp 4 NS Grn R Turn	Lamp 5 EW Red	Lamp 6 EW Yel	Lamp 7 EW Grn	Lamp 8 EW Grn R turn	Remark	Time Secs.
1	1	0	0	0	1	0	0	0	Both Roads Red	2
2	0	0	0	1	1	0	0	0	NS Red OFF; NS Grn (R Turn) ON	22
3	0	1	0	0	1	0	0	0	NS Grn (R Turn) OFF; NS Yel ON.	2
4	0	0	1	0	1	0	0	0	NS Yel OFF; NS Grn ON.	24
5	0	1	0	0	1	0	0	0	NS Grn OFF; NS Yel ON.	2
6	1	0	0	0	1	0	0	0	Both Roads Red	2
7	1	0	0	0	0	0	0	1	EW Red OFF; EW Grn (R Turn) ON	22
8	1	0	0	0	0	1	0	0	EW Grn (R Turn) OFF; EW Yel ON.	2
9	1	0	0	0	0	0	1	0	EW Yel OFF; EW Grn ON.	34
10	1	0	0	0	0	1	0	0	EW Grn OFF; EW Yel ON.	2
									Total	114

Abbreviations:

0	Lamp 'off'
1	Lamp 'on'
NS Yel	North-South Yellow
NS Grn	North-South Green (Straight)
NS Grn (R Turn)	North-South Green (Right Turn)
EW Yel	East-West Yellow
EW Grn	East-West Green (Straight)
EW Grn (R Turn)	East-West Green (Right Turn)

The O/Ps of 2716 are connected to the 7406 inverters. The 7406 is hex buffer/driver with open collector O/Ps, which can source/sink up to 30 milliamperes of current and the O/Ps can be connected to DC voltage up to 30 volts.

One light emitting diode (LED) is connected to the O/P of 7406 inverters through a current limiting resistor (R6). In our example, we have used 470-ohm resistor. In case the positive supply is not 6 volts (if some other relay with different coil voltage is used), the current limiting resistor should be modified accordingly. About 8 to 12 milliamperes of DC current is sufficient for a normal glow of the LED. So, if the

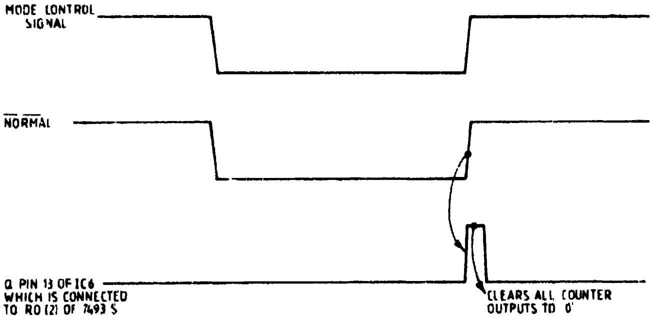

MODE CONTROL SIGNAL
NORMAL
Q PIN 13 OF IC6 WHICH IS CONNECTED TO RO(2) OF 7493 S
CLEARS ALL COUNTER OUTPUTS TO '0'

Fig. 3: Suitable power supply for the circuit.

ositive supply voltage is 12 volts, R5 may be changed to 1k r 1.2k. Similarly, for 24 volts positive supply, a 2.2k resistor nay be used. The LEDs are used only for visual indication and testing of prototype, and are not required for the functioning of the circuit, and therefore may be eliminated, if so desired.

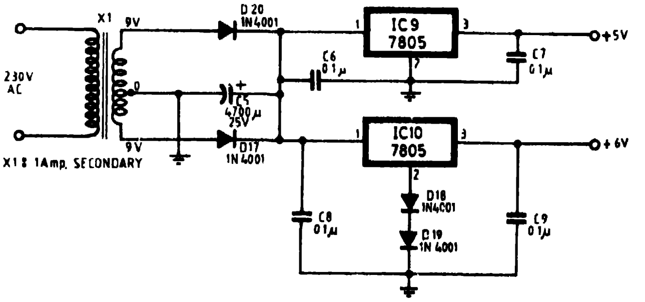


Fig. 4: Synchronisation timing waveform at various modes.

The base of a pnp transistor (T2) is connected to the O/P of 7406 inverter through a 4.7k resistor. The collector of the pnp transistor is connected to ground and a DC relay is connected through positive supply to its emitter. (In our example, we have used a 6V DC relay.)

So, when the O/P of 2716 chip is high (say, D0, i.e. pin 9 of 2716), it will be inverted and pin 2 of 7406 will become low. This will turn 'on' the LED and also transistor T2. Thus, the relay coil will be energised and lamp 8, which is connected through the relay contacts will turn 'on'. On the other hand, if the 2716 O/P is low, the 7406 inverter O/P will be high and the LED as well as the transistor (and thus the relay) will remain off. Thus, we can control all the eight lamps in any combination.

The relay driver circuit in our example uses BC158 driver transistor. It will be suitable, as long as the coil current is less than 400 mA. In case some other DC relay is used, the driver circuit may have to be modified. In case the relay coil voltage is less than 30 volts and the coil current is less than 100 mA, the same circuit may be used. However, if relay coil voltage is less than 30 volts but the coil current is more than 100 mA, some other pnp transistor with higher power rating (say, ECP055) has to used. But in case of more than 30V DC relay, the 7406 IC cannot be used and a suitable driver circuit has to be redesigned.

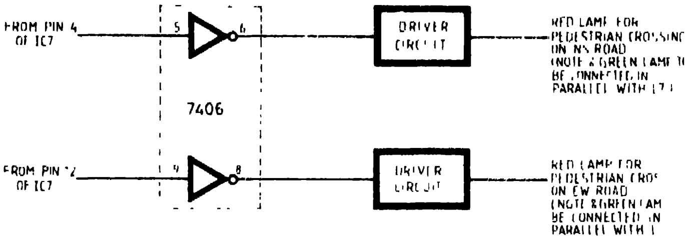


Fig. 5: Addition to main circuit to implement the pedestrian lights.

Power supply

Power supply for the traffic control circuit is very simple as it requires only +5 volts. The power supply circuit uses one step-down transformer, two rectifier diodes D17 and D20), one filter capacitor (C5) and a+5-volt voltage regulator IC9 (7805 or equiv.). The voltage regulator should be mounted on a suitable heatsink.

The DC supply for the coils of the relays can be generated by using either an adjustable voltage regulator (78HG) or by simply connecting two diodes to the 'common' terminal of the 7805 voltage regulator, as shown in Fig. 3. The circuit will give around 6 volts DC supply.

The voltage regulator should be mounted on a suitable heatsink. The common terminal of the voltage regulator should be isolated from the heatsink. In case the relay coil voltage is other than 6 volts, a suitable power supply has to be designed for driving the relay coils.

Operation of the circuit

The operation of the circuit is very simple. As explained earlier, IC 555 generates the basic clock for the circuit, which is fed to a chain of three 7493s that generate 10 address lines for the 2716 chip. These lines are A0 through A9.

The 'mode control signal' which comes from the 'control room' is connected to the base of a transistor T1. If the base of T1 is open/high, the transistor will remain in cut-off state and the signal $\overline{\text{NORMAL}}$, which is connected to A10 (the most significant address line) of the 2716, remains high. And, if the mode control signal is low, or if switch S1 is closed, transistor T1 conducts and the signal $\overline{\text{NORMAL}}$ (A10) becomes low. The signal $\overline{\text{NORMAL}}$ is also connected to one monoshot IC 74123 (IC6). Its function will be explained in the latter part of this article.

As the 2716 has 11 address lines, it contains 2k, i.e. 2048 bytes of data. So, if the most significant address line (A10) is low, the lower 1024 (1k) address locations are selected (Address: 000 to 3FF hex). And, if A10 is high, the upper 1k addresses are selected (Address: 400 hex to 7FF hex). The lower 1k bytes are used to store data for hold mode and the upper 1k bytes are used for normal mode.

Now let us study the normal mode, the hold mode and synchronisation in detail.

Normal mode

As explained earlier, A10 is high during this mode and the upper 1k bytes are used to store data for this mode. The total time taken to complete one traffic cycle in our example (Table 1) is 114 seconds for all the 10 steps. This time has to be covered in 1024 clock cycles. Therefore, the clock frequency should be 1024/114, i.e. 9 Hz approximately.

The duration of step 1 is 2 seconds. So, 9×2, i.e. 18 addresses (locations) will be used to store the duration corresponding to step 1. Therefore, step 1 will start at address 400 hex and continue up to 411 hex (400 hex to 411 hex, both inclusive, is 18 locations), and since lamp 1 (bit 7) and lamp 5 (bit 3) should be 'on' (and rest all 'off'), '1000 1000', i.e. 88 hex should be stored at these address locations.

The duration of step 2 is 22 seconds, which will be covered in 22×9, i.e. 198 clock cycles. Since only lamp 4 and lamp 5 should be 'on' during step 2, the data '0001 1000' (18 hex) should be stored from 412 hex to 4D7 hex locations. Similarly, we can calculate the addresses and the data stored therein for other steps too. These values are listed in Table 2.

TABLE 2

Steps	Duration	Clock Cycles	Address (Hex)	Data (Hex)
1	2	18	400 - 411	88
2	22	198	412 - 4D7	18
3	2	18	4D8 - 4E9	48
4	24	216	4EA - 5C1	28
5	2	18	5C2 - 5D3	48
6	2	18	5D4 - 5E5	88
7	22	198	5E6 - 6AB	81
8	2	18	6AC - 6BD	84
9	34	306*	6BF - 7EE	82
10	2	18	7EF - 7FF	84

* Actually 304 address locations are used so as to make the sum of the clock cycles, for all the steps, equal to 1024 This will reduce step 9 to 34 × 304/306, i.e. 33.78 seconds.

So, if the 2716 contains data as per Table 2, and A10 is high, the 2716 will continue to give data which will control the relays, which in turn finally control the traffic lights as per our requirements. The address will start at 400 hex and will keep on getting incremented, and the 2716 will keep on selecting new steps after required number of clock cycles

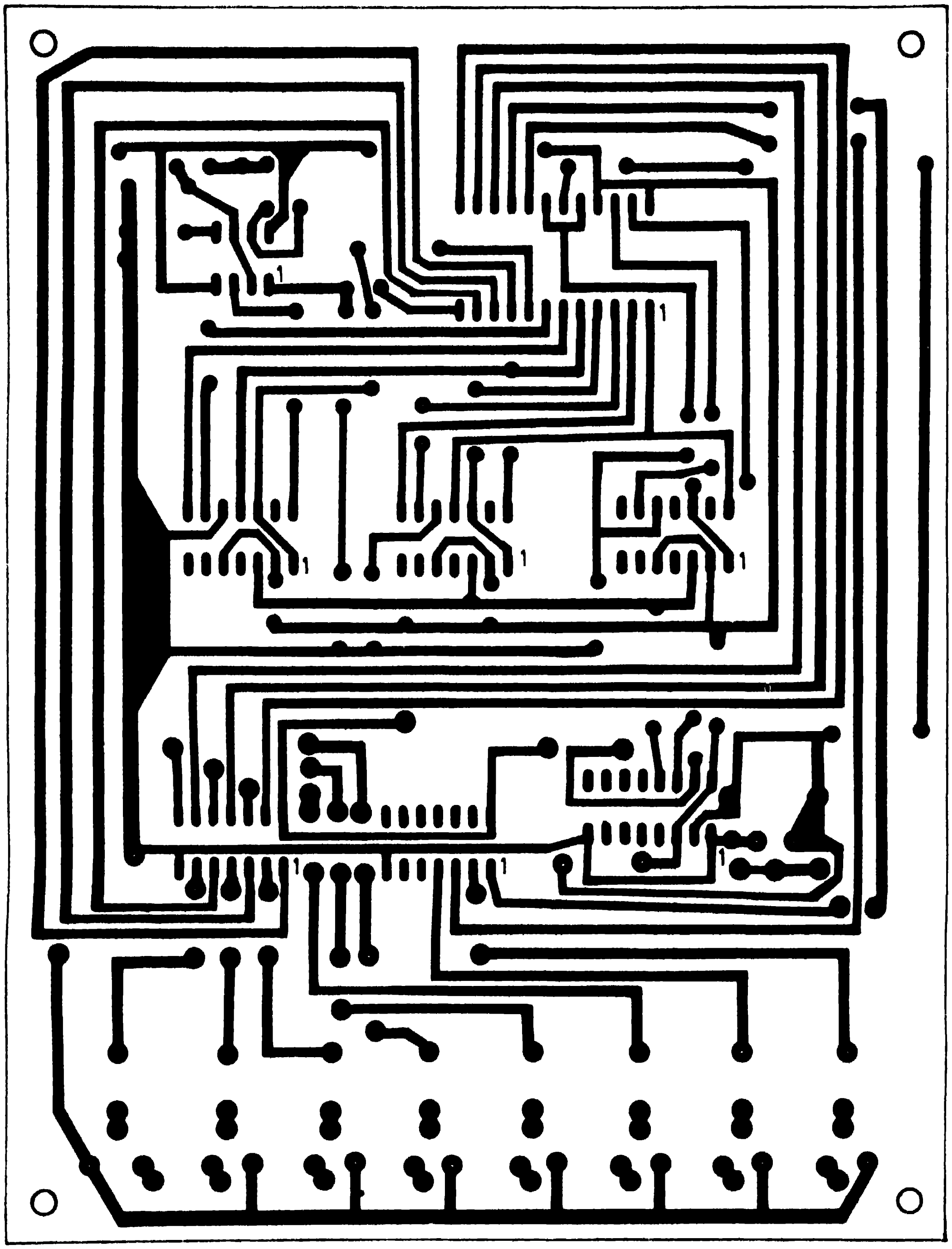


Fig. 6: Actual size PCB layout for the circuit.

when the current steps are over. When the address becomes 7FF (the last address for step 10; also last address of the 2716), it will once again become 400 hex at the next clock cycle. So, the traffic light will continue to run in normal mode.

Hold mode

The hold mode is similar to normal mode, except that the lower half of the 2716 (lower 1k bytes) is used and the A10 is low during this mode. The circuit can enter into this mode by closing switch S1 or by making 'mode control line' low through remote control.

In hold mode, the yellow lights keep on blinking. Let us fix the blinking rate to 0.5Hz, i.e. yellow lights are on for one second and off for the next one second. As per Table 1, lamp numbers 2 and 6 are used for yellow lights.

As we are using 9Hz clock, we should store '0100 0100', i.e. 44 hex data in the first 9 locations (000 to 008) and '0000 0000' should be stored in the next 9 locations, and then '44' hex in next 9 locations, and so on. This should be continued up to address 3FF hex.

Since in hold mode the A10 remains low, the address starts at '000' and is incremented up to '3FF' Thereafter, it once again starts from '000'. So, in hold mode the yellow

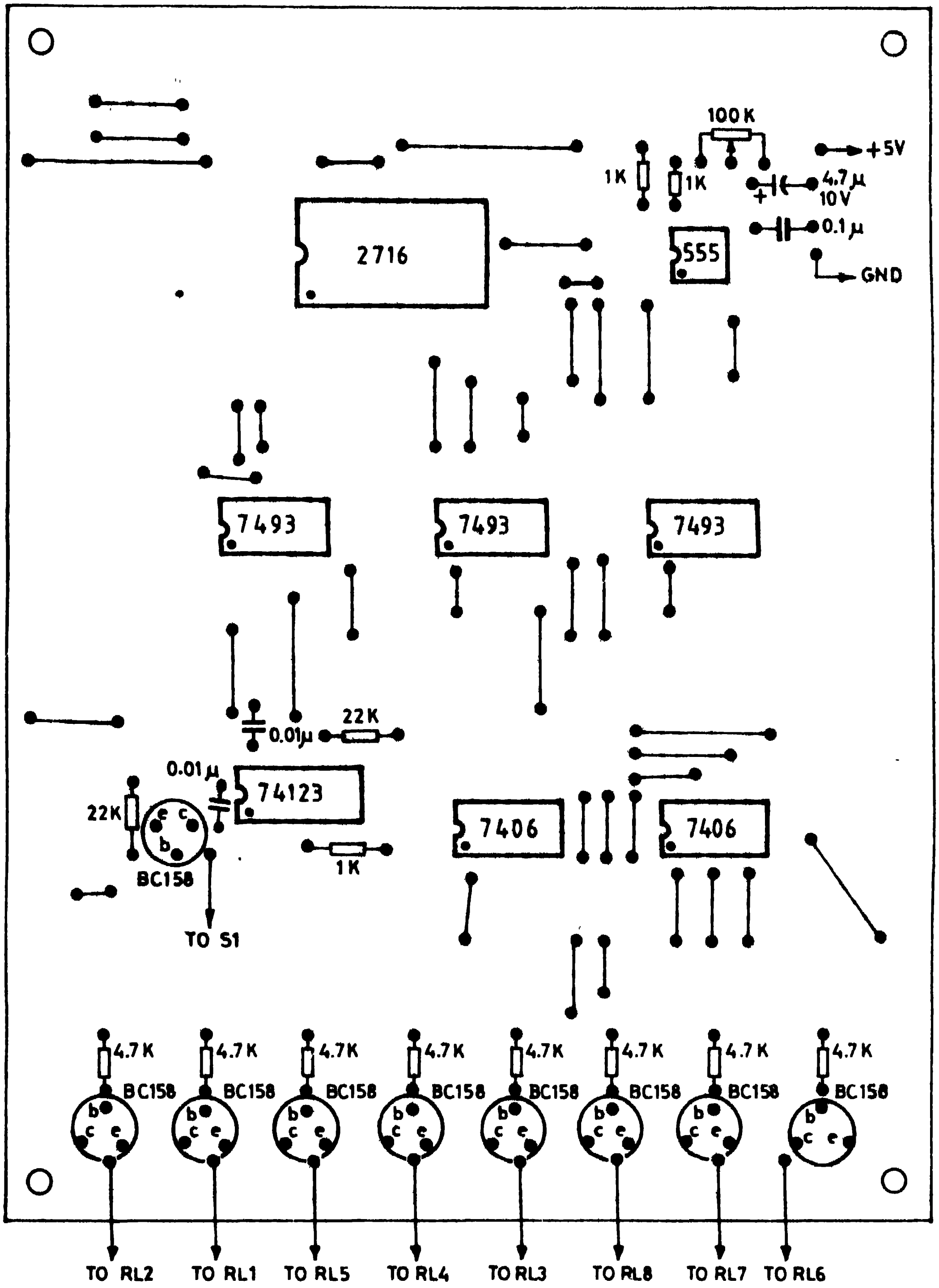


Fig. 7: Components layout for the PCB.

lights will keep blinking at 0.5Hz rate.

In case some other blinking rate is required, it can be easily achieved by varying the number of locations for lights that are on (data '44') and the lights that are off (data '00') in the 2716.

Synchronisation

Synchronisation means starting the traffic lights from step 1 at a particular moment, through remote control. As explained earlier, this helps in smooth running of traffic on busy roads.

We have not explained the function of 74123 (IC6). The IC 74123 contains dual monoshots. Only one monoshot is used in this circuit. The circuit is configured in such a way that it triggers the monoshot at the 'positive going pulse' at 'B I/P' (pin 2 of IC6).

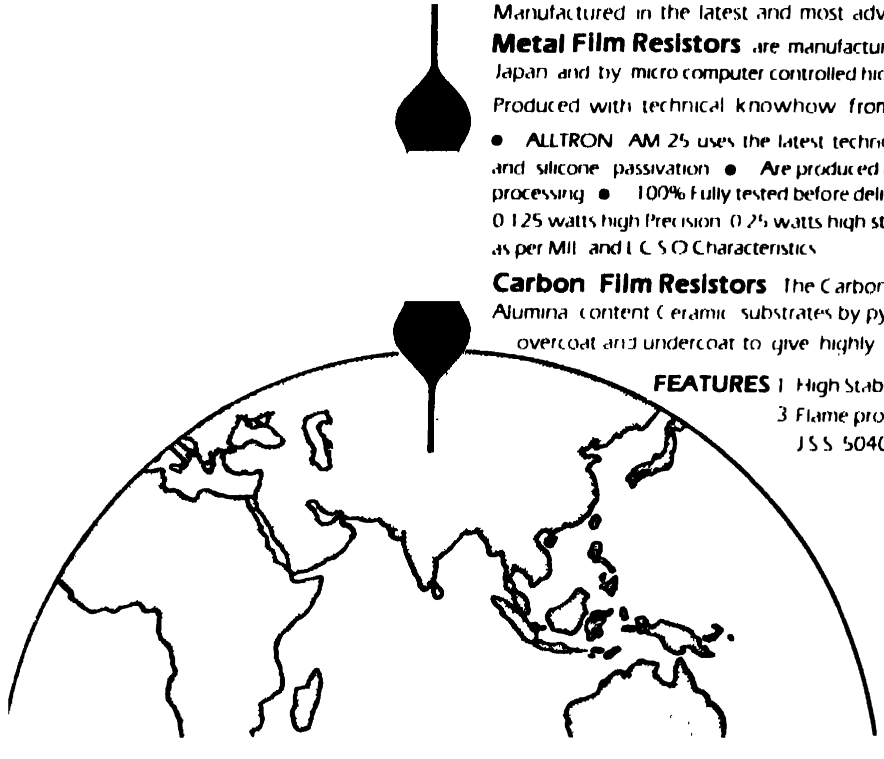
IC6 is used here for synchronisation. For using this feature, first we have to put the control circuit in hold mode by making mode control signal 'low' As a result, the $\overline{\text{NORMAL}}$ line becomes low. But this does not 'trigger' the monoshot of IC6, as the monoshot (IC6) is configured to trigger on high going pulse only. But when the 'low' level from the mode control line is removed, the $\overline{\text{NORMAL}}$ line goes from low to high. This triggers the monoshot and a 'high' pulse is generated at the 'Q O P' of 74123, which is connected to the 'R0' (pin 3) of the counters. This sets the O/Ps of all the counters to zero. The timings are shown in Fig. 4. So, the effective address applied to the 2716 chip is '400 hex' ($\overline{\text{NORMAL}}$ (A10) is high) and the control sequence starts from step 1. Thus, the traffic lights can be put in synchronisation by making mode control line low and then high at the desired moment.

So, we have seen that this simple circuit has all the features of a good traffic control system. It is also possible to have two 2716 chips in the circuit so that two traffic light control sequences are stored, and any one of the two sequences may be selected with the help of a simple switch. For doing this, all the pins of both the 2716 chips, except pin 18, should be joined together. Pin 18 of the two 2716 chips should be connected through a DPDT switch in such a way that the switch makes pin 18 of the first chip low (and that of the other chip high) when in one position and vice versa. Thus, the chip with a low pin 18 will be selected and the control sequence stored therein.

In case more than 8 O/P lines are required, two 2716 chips should be used in such a way that all the I/Ps are common (i.e. A0-A10), Chip Select (18) and Output Enable (20)). Thus both the chips will be selected simultaneously and we can control up to 16 lights (8 through each 2716 chip) in any combination.

Many traffic lights give 'green/red' signal for crossing the roads to pedestrians also. This is also possible in our original circuit. (Refer to Figs 1 and 2.) The pedestrian should cross North-South road only when there is no movement of traffic on North-South road from any direction. This condition is true only when the traffic is moving in East-West (straight) direction. Or in other words, when lamp 7 is on. So, light for the pedestrian who wants to cross North-South road should be green only when lamp 7 is on, and should be red for rest of the time. Thus, the green light in this case can be connected in parallel to lamp 7 and an inverter can be connected from pin 4 of IC7 (Fig. 2) and the O/P of this inverter can drive the driver circuit for controlling red light for pedestrian crossing. A similar addition will be required for the pedestrian who wants to cross East-West road. This is shown in Fig. 5.

All the components used in this traffic control circuit are easily available in local markets. The circuit can be easily wired on a general-purpose PCB. But some readers may find it difficult to get the 2716 EPROM programmed. If they do not have access to a PROM programmer, they may contact EFY for pre-programmed EPROMs containing data as per Table 1. □



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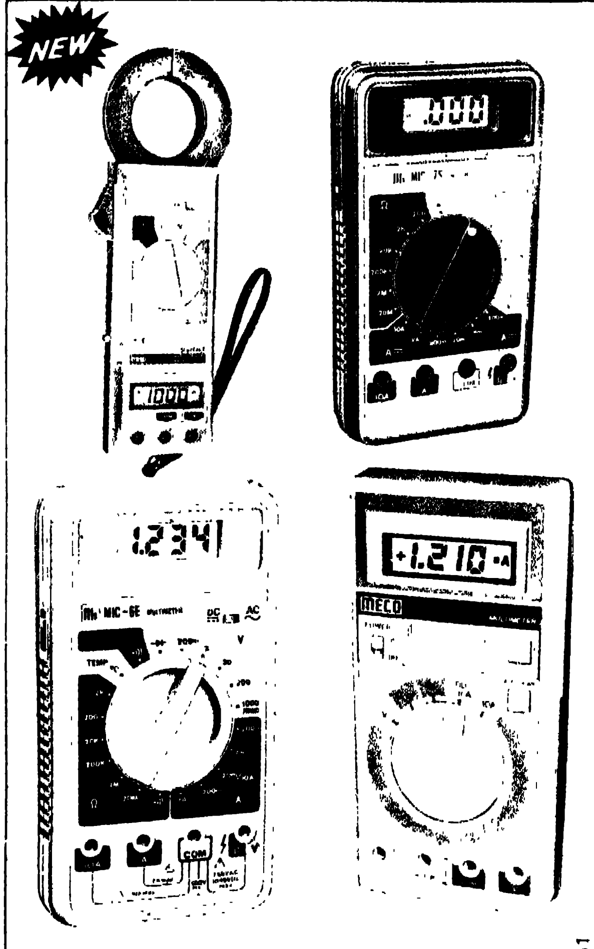

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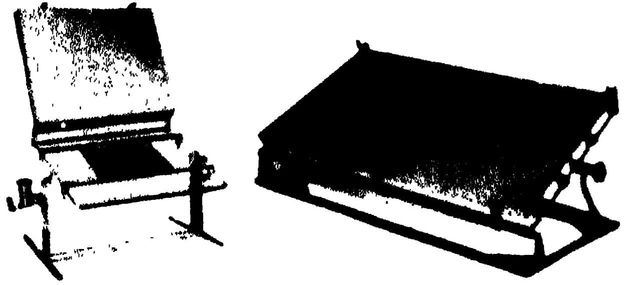

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IS 2	ISFL 2	300 × 450
IS 3	ISFL 3	200 × 300
IS 4	ISFL 4	325 × 550

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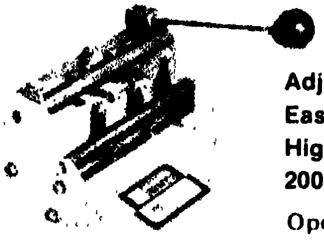

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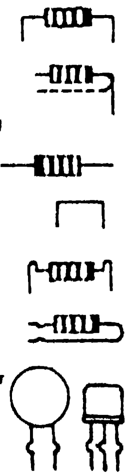

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Envelope Follower For Guitars and Organs

Very little has been done in India regarding electronic musical instruments while Indian musical instruments field has been totally ignored. For amateur guitarists it is very difficult to obtain electronic gadgets since they are not made locally. Hence, an electronic musical gadget is presented here for those who are unable to buy such units because of their high cost or total non-availability.

This unit produces a similar effect as a 'Wah-Wah' which is familiar to most music enthusiasts, but it is automated. It is actually designed for electric guitars though it is equally adaptable for electronic organs. It is connected between the guitar and power amplifier and gives the 'Wah' effect automatically whenever you play the guitar. Professional grade quality can be obtained from this unit.

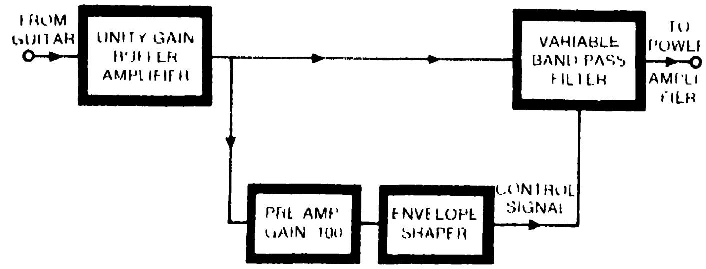
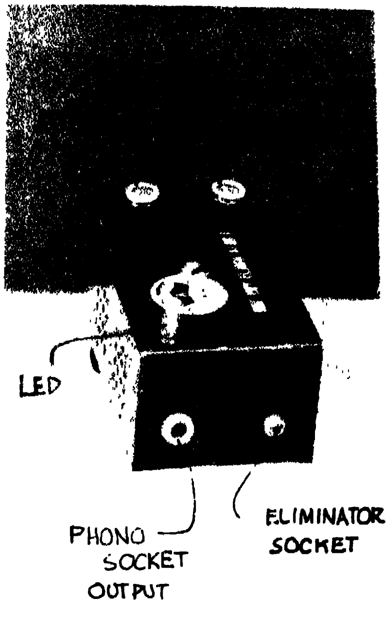


Fig. 1: Block diagram for an envelope follower.

The circuit

It is clear from the block diagram in Fig. 1 that it is a variable band-pass filter whose passband is controlled by the envelope of the input audio signal itself. The complete circuit diagram is shown in Fig. 2.

Op-amp A1 is connected as a unity gain buffer amplifier. R1, R2 and C1 are chosen to give the circuit a moderate input impedance. The inverted audio signals obtained from A1 are made to pass through a passive high-pass filter formed by C3 and R3.



The author's prototype of the envelope follower.

Op-amp A2 is connected as a preamplifier with a gain of

Mr Gowdama Chandran is an experienced guitarist as well as an electronics hobbyist, though he's a civil engineering draughtsman by profession.

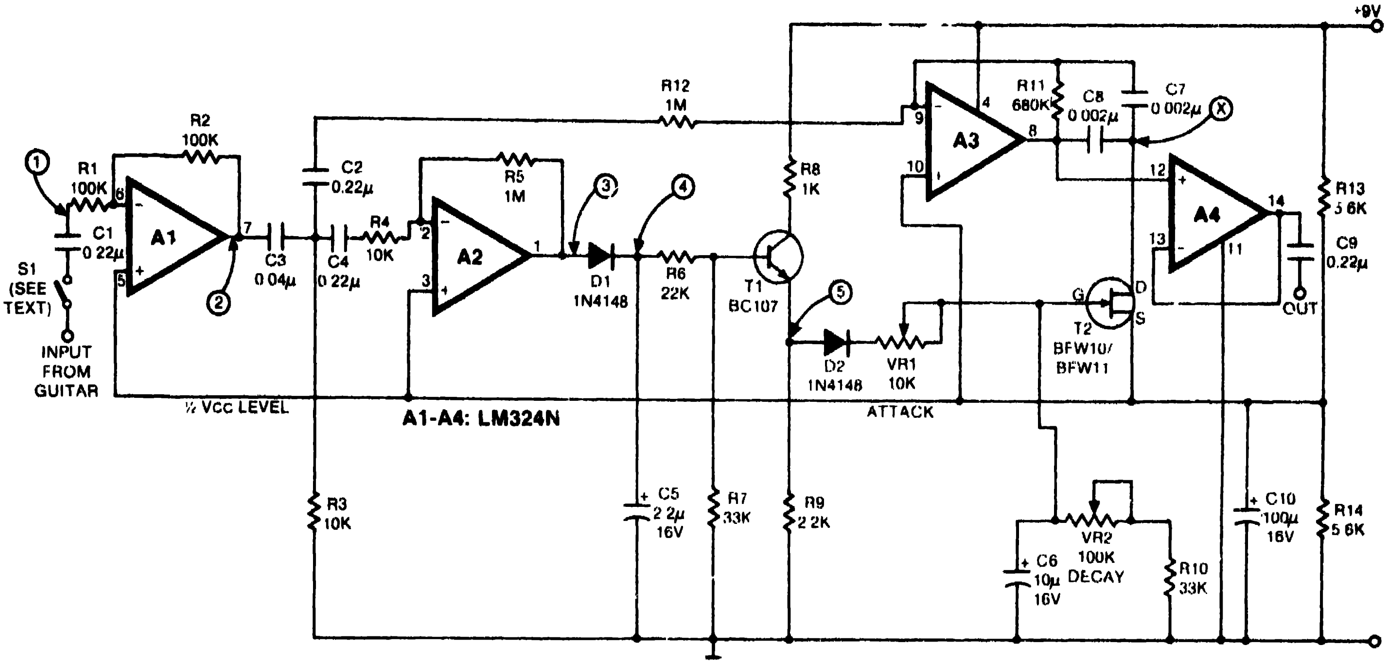


Fig. 2: Circuit diagram for the envelope follower.

PARTS LIST

Semiconductors:

IC1 — LM324 quad op-amp
T1 — BC107 npn transistor
T2 — BFW10/BFW11 field effect transistor
D1, D2 — 1N4148 silicon switching diode
D3 — 5mm LED

Resistors [*all* ¼ watt, ±5% *carbon*]:

R1, R2 — 100-kilohm
R3, R4 — 10-kilohm
R5, R12 — 1-megohm
R6 — 22-kilohm
R7, R10 — 33-kilohm
R8 — 1-kilohm
R9 — 2.2-kilohm
R11 — 680-kilohm
R13, R14 — 5.6-kilohm
R15 — 680-ohm
VR1 — 10-kilohm, linear potentiometer
VR2 — 100-kilohm, linear potentiometer

Capacitors:

C1, C2, C4,
C9 — 0.22μF ceramic disc
C3 — 0.04μF ceramic disc
C5 — 2.2μF, 16V electrolytic
C6 — 10μF, 16V electrolytic
C7, C8 — 0.002μF ceramic disc
C10 — 100μF, 16V electrolytic

Miscellaneous:

S1 — Push-to-on DPDT switch
— PCB, battery holder, phono sockets, enclosure, screws, nuts, other hardware etc.

100. The amplification is decided by resistors R5 and R4. Capacitor C4 is included to isolate the input of the preamp from negative potential.

The amplified signal is rectified by diode D1 while capacitor C5 eliminates the AC components. This DC voltage obtained is known as the envelope of the input signal.

Since the output of op-amp A2 will be at ½ Vcc at rest, the envelope signal will be swinging above this level only, which is undesirable. Hence transistor T1 is employed to lower this base level. Resistors R6 and R7 give bias for the base of T1 while R8 is used as collector load resistor. Resistor R9 has been chosen to develop the required DC level at emitter of T1.

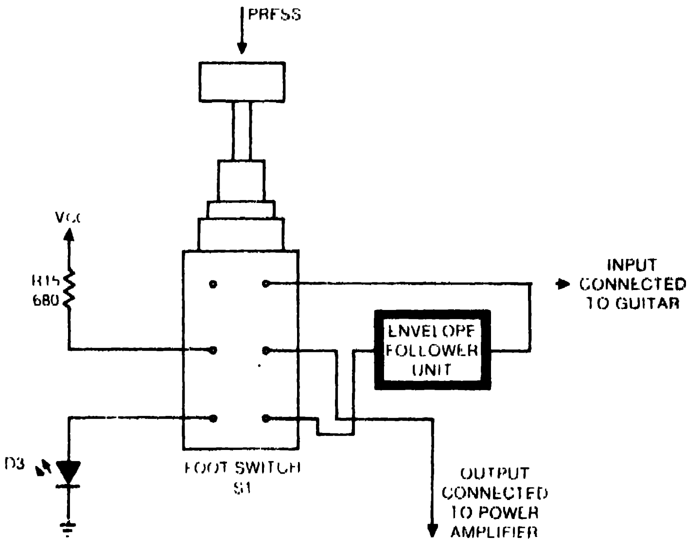


Fig. 3: Wiring diagram for foot-operated DPDT switch.

Filter

Op-amp A3 forms the band-pass filter. R11 is the feedback resistor while C7 and C8 are the components that decide the 'Q' factor of the filter.

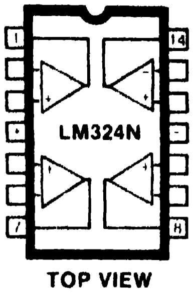


Fig. 4: Pin configuration of IC LM324.

Note that the input resistor R12 is greater in value than the feedback resistor R11 and is not connected to point 'X' in the circuit. On the contrary, it has been connected to the inverting input of A3 and gives a brilliant tone 'colour'.

C2 is the DC blocking capacitor. Resistance offered between points 'X' and ½ Vcc decides the passband of the filter. Here field-effect transistor T2 is utilised as a variable resistor connected between these two points.

Although the FET's drain and source terminals are interchangeable, they are connected to higher and lower impedance points respectively. The gate terminal is negatively biased through R10 and VR2.

The envelope voltage from T1's emitter is applied through D2 and VR1 to the gate of the FET. This voltage charges C6 which shapes the envelope. D2 prevents C6 from discharging through R9 and hence the discharge is possible through VR2 and R10 only. The 'attack' and 'decay' of the envelope is adjustable by VR1 and VR2 respectively.

At rest, the gate of T2 is negatively biased and hence a very high resistance is offered between the drain and source terminals of the FET. When the envelope is present the resistance varies accordingly. It follows that the passband of the filter is made to sweep across the audio spectrum which gives a 'Wah' effect.

The output of A3 is buffered by the voltage follower built around A4 and DC blocking capacitor C9. Finally, ½ Vcc is developed by the potential divider comprising R13 and R14, and is smoothed by C10.

The circuit is powered by a 9V, PP3 battery. It may be powered by a battery eliminator, but a regulated power supply is preferable.

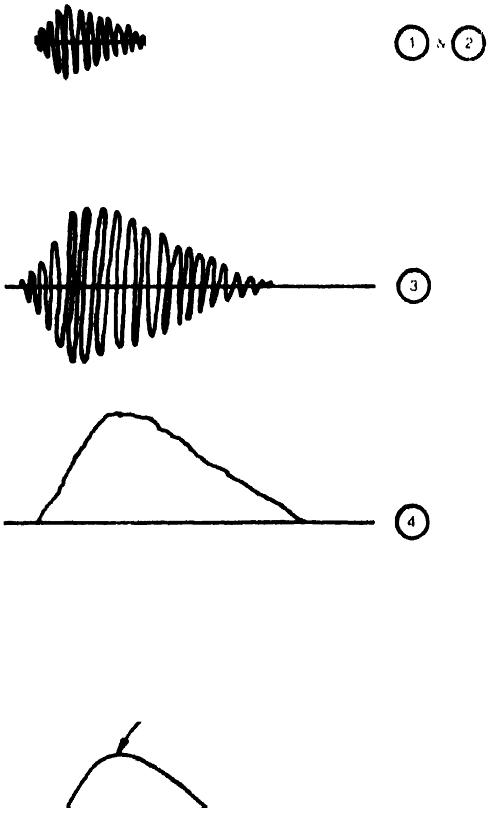


Fig. 5: Typical waveforms observed on a scope at various points in the circuit.

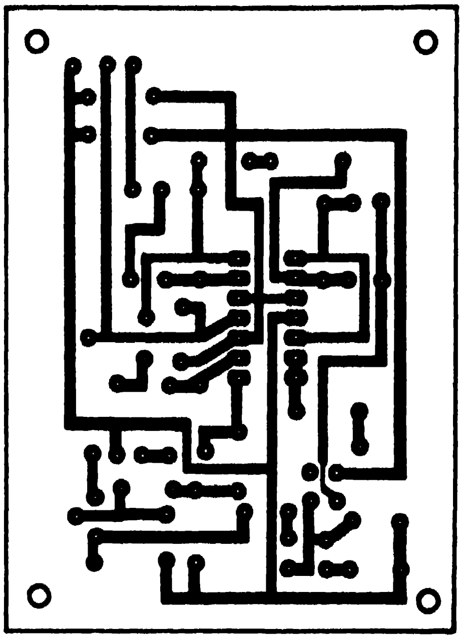
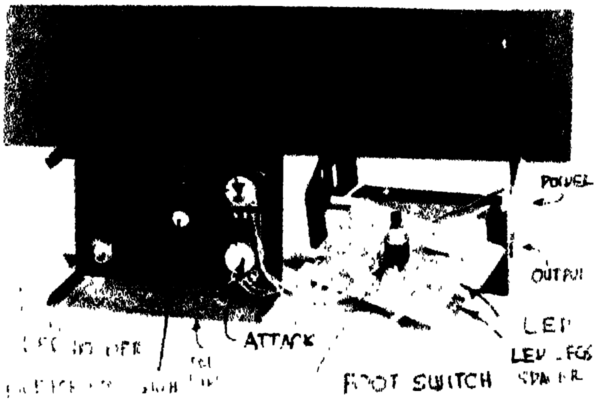


Fig. 6: Actual-size PCB pattern for the circuit.



Inside view of the author's prototype.

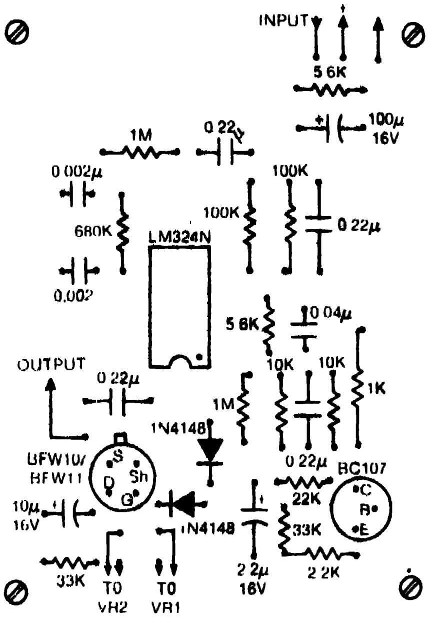


Fig. 7: Components layout for the PCB.

Construction

Any op-amp may be used for A1 to A4. However, quad op-amp LM324N is recommended for its low cost and simplicity of the layout. The pin configuration of this IC is given in Fig. 4.

The printed circuit board shown in Fig. 6 makes the construction simple and easy. The assembled board may be housed in an eliminator box to save the labour for cutting and bending sheet metal for a special enclosure. A foot switch should be provided at the top of the box to permit easy switching 'in' and 'out' of the unit in the guitar-amplifier path.

An LED is provided to indicate whether the unit is switched 'in' or 'out' of the circuit. Note that the LED should be mounted on the top lid of the box. VR1 and VR2 should also be mounted on the top lid, without obstructing visibility of the LED.

Phono sockets can be used for signal 'in' and 'out' terminals. The power supply may be kept outside the box in another case of a battery eliminator.

The assembled unit should give an excellent performance with a guitar. If an organ is connected to it, the components responsible for 'attack' part of the envelope should be modified. A resistor of 10k to 47k value should be inserted between D2 and VR1, depending upon the signal level of the organ used. □

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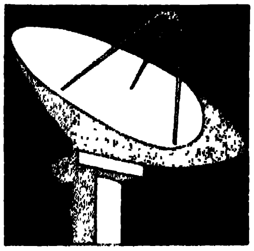

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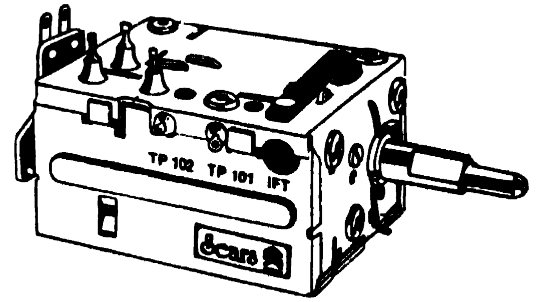

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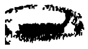

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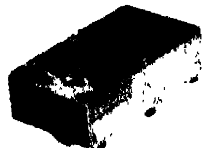

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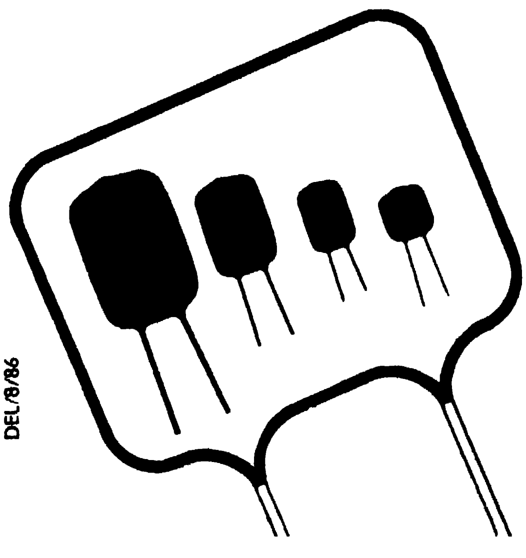

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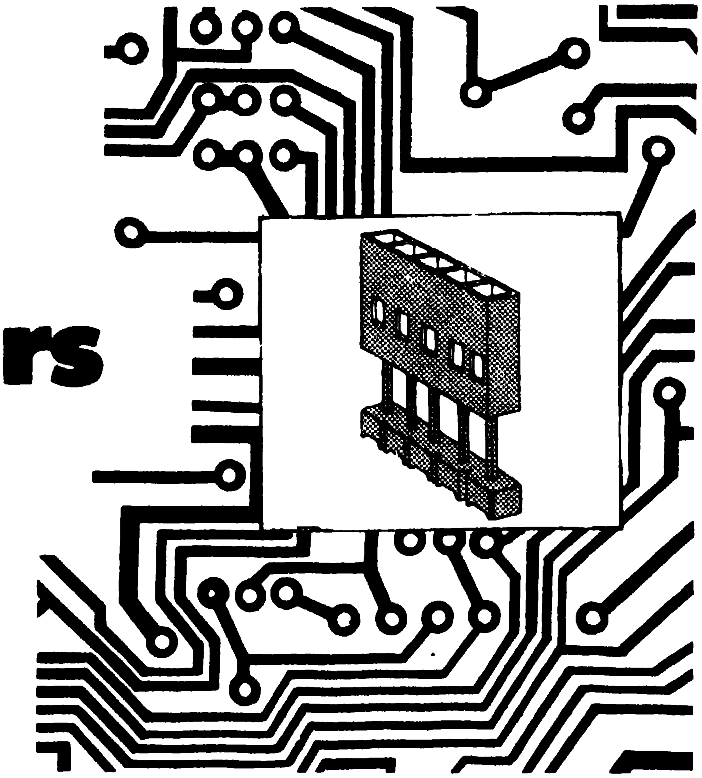

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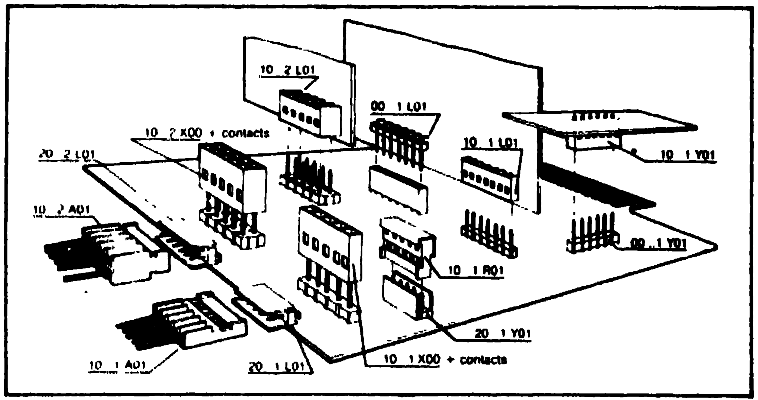

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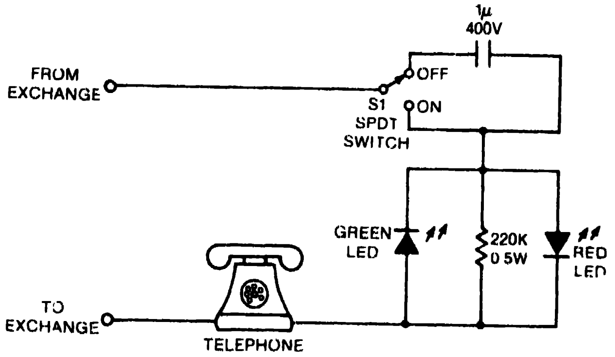
M86.22

Electronic Phone Lock

This very simple to construct device can be housed in a small plastic cabinet of the size of a match box. It is to be connected in series with the phone as shown in the diagram.

When the handset is removed from cradle, one of the LEDs lights up, indicating that the phone is not dead. And on dialing the required number, the LEDs start flickering, indicating that the number is being dialled. This way one can detect whether someone is misusing the phone from the wires going outside the house.



Once the ringing tone reaches the caller and the caller lifts his own handset, the other LED lights up indicating that the call is matured. (For differentiation, two different coloured LEDs have been used.) This happens due to reversal of the polarity of voltage in the exchange wires.

•When switch S1 is moved to 'off' position, the capacitor is introduced in the circuit. In this position the phone becomes 'dead' for the outgoing calls but the incoming calls regularly come through the capacitor, i.e. you can listen to the voice of the caller but they cannot listen to your voice. So, to enable the incoming calls, the switch should be moved to 'on' position and the conversation made as usual.

R.K. GUPTA

Field Failure Protection for DC Motors

The speed of a DC motor is extensively used for industrial applications where a precise speed control and a constant torque are desired. It is inversely proprotional to its field current. In case of field current failure, the motor speed will rise to dangerously high level. A field failure protection is therefore necessary to cut off the armature supply in case of field current failure.

The basic circuit of the field failure protection uses an ordinary 6V electromagnetic relay of the open type with 10 amps rated sturdy contacts. This relay can be used on a manual autotransformer-controlled DC drive. This motor has a shunt field current of 1.13 amps at 220V DC. A 5-ohm (25-watt) wirewound resistor (R1) connected in series with the motor field produces a 5.6-volt drop across resistor (R1) as long as the field current exists, thus energising the 6V DC relay connected across the resistor as shown in Fig. 1.

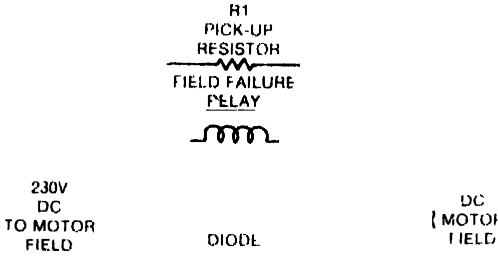


Fig. 1

In case the motor field current fails due to any fault, the voltage drop across resistor (R1) will be zero which de-energises the relay (FFR) and cuts off the armature supply.

The circuit diagram of a manual autotransformer-controlled DC drive of a 230V, 5HP DC motor with a separately excited shunt field of 230 volts (1.13 amps) and the FFR (field failure relay) circuit are shown in Figs 2 and 3 respectively. When the start pushbutton S2 is pressed, the contactor C is energised through S2 (N/O contact), limit switch S3 and stop pushbutton S1 (N/C contact).

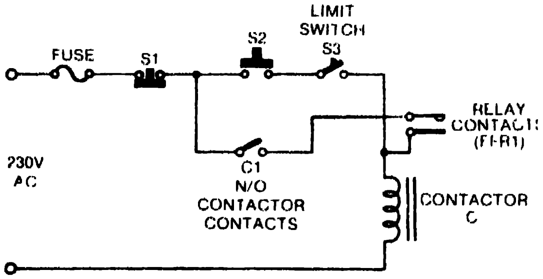


Fig. 2

The limit switch S3 is actually a part of the autotransformer, and it is so mounted that its contacts remain closed only when the autotransformer setting is at zero position. At all other settings of the autotransformer, the limit switch contacts remain open. This is a safety device introduced, so that the motor can be started only from the minimum position of the autotransformer setting, thereby starting at reduced voltage and current. If the motor is started on a high armature voltage, the starting current will be very high, especially if started on load, as is usually the case.

As soon as the contactor C is energised, its contacts C1-C3

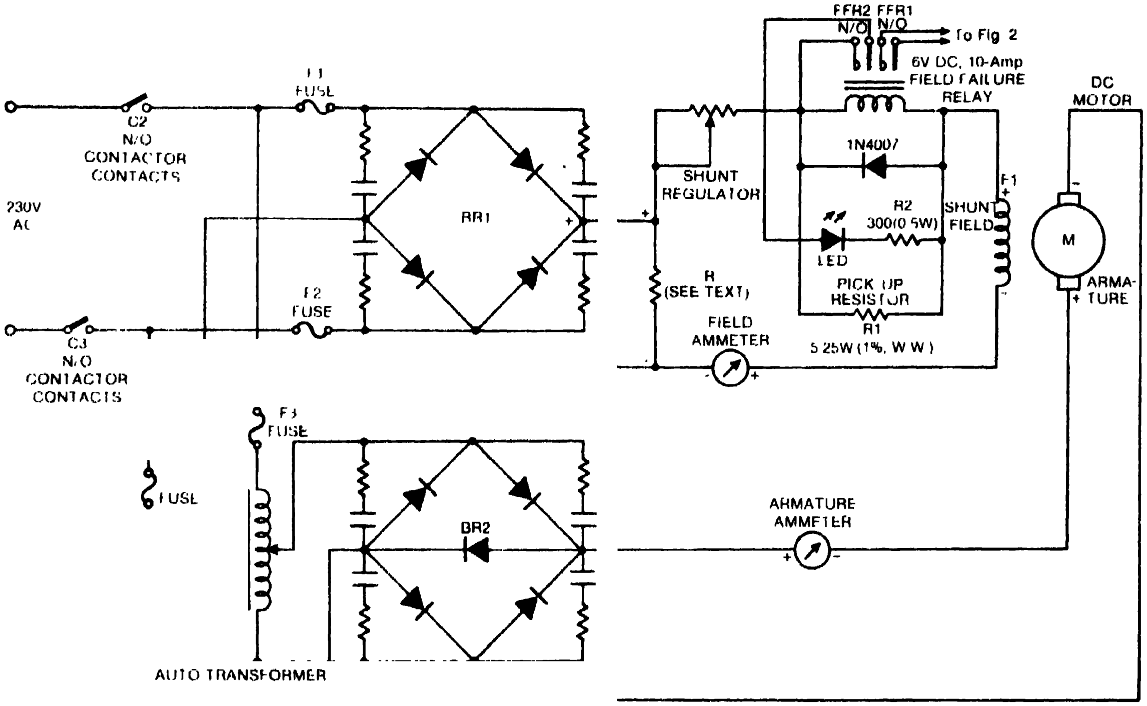


Fig. 3

are closed. A 230V AC is now available at the autotransformer input terminals, and a 230V DC via full-wave bridge rectifier BR1 and series resistor R1 to the motor field winding.

As soon as field current flows, the drop across R1 energises the FFR. FFR has got two pairs of N/O contacts, FFR1 and FFR2, which now close. FFR1 when closed provides a retaining supply to contactor C through its own contact C1, and becomes independent of S2 (which can now be released) and S3.

The motor can now be started by increasing the autotransformer setting whereby the output through the bridge rectifier BR2 applies a DC voltage to the motor armature to smoothly start the motor at a speed depending upon the setting of the autotransformer. In case of field current failure, FFR drops and contactor C opens to disconnect armature supply.

The FFR2 contacts (which are optional, but are useful as shown here) provide an LED indication that the FFR is operating. Alternatively, an ammeter can be used in the field circuit to show that the field current is flowing.

The RC network across the diodes is for surge protection of the diodes only. Usually a wirewound resistor (20k, 25W if the field excitation voltage is 230V DC) is connected across the rectifier output to the highly inductive field winding, whereas a fifth diode is connected with reverse polarity across the bridge rectifier (BR2) output to the armature.

Note that R1 (5-ohm), connected in series with the field winding will have negligible effect in the field current (field resistance being above 200 ohms). However, if one wishes to reduce the voltage drop across R1, two 5-ohm, 15W resistors may be used in parallel, and the FFR replaced by a 3V DC-operated relay which is available with some manufacturers.

Note: EFY is not responsible for any malfunctioning in the circuit as the same has not been tested in our lab.

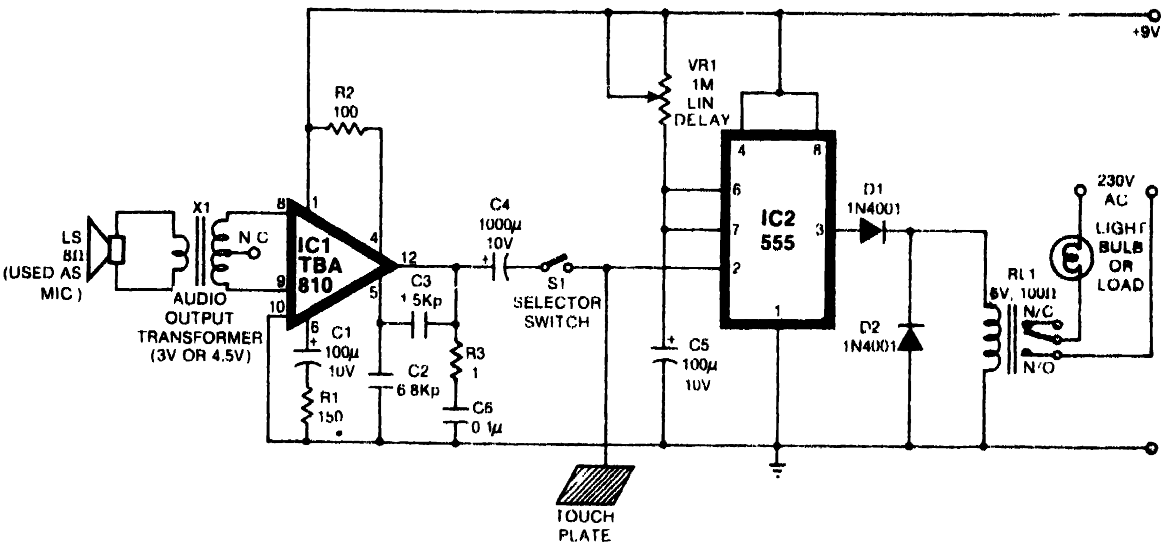
E. AUGUSTINE

Clap Switch-Cum-Touch Switch With Timer

The two-in-one circuit described here is very simple. It can be used as a sound or clap switch with timer, and also as a touch switch with timer. It will cost around Rs 80 only. Power consumption for this circuit is 20 mA at 9 volts when relay is in 'off' state and 100 mA at 9 volts when relay is in 'on' state.

This circuit uses TBA810, a 7-watt audio amplifier, along with IC 555 timer circuit. Output of the amplifier is given to pin 2 of IC 555 through switch S1. Output transformer of 3 volts is connected at the input of audio amplifier with its 8-ohm side towards the speaker. The centre terminal of this transformer is kept open.

When a 9-volt supply is applied to the circuit with closing switch S1, the relay operates. It remains in this 'on' state for certain interval of time due to the timer circuit. This interval of time can be changed by potentiometer VR1. When relay switches to 'off' state after some time, a clap sound made in front of speaker actuates the relay for certain interval of time



again. This process can be repeated. The range for this clap switch is about three metres if a good speaker with light cone is used.

If switch S1 is open and the metallic plate is touched with a finger, the relay operates for some time and then switches to 'off' state. So this circuit can be used as touch switch with timer.

The sound switch can be used as a doorlight. In the dark, a clap can switch on a light bulb connected in relay circuit for certain interval of time. The circuit can also be used in toy motors so that a clap makes the toy motor start rotating and stop after some time.

Similarly, touch switch can also be used for doorlight or with a toy motor as mentioned above.

To save your cash box from being stolen, you can connect a wire from touch switch to the cash box. When someone touches your cash box, an electric bell connected in the relay circuit can be sounded.

Lab Note. Sensitivity of the circuit can be increased by replacing the audio output transformer connected between IC1 and speaker with a 0-18V (500 mA) step-down transformer by connecting its primary windings to IC1 and secondary to the speaker acting as a microphone

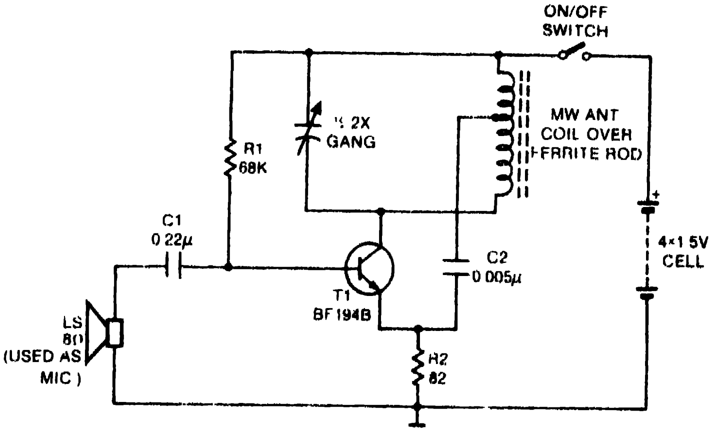
R.V. DHEKALE

Simple AM Radio Transmitter

This very simple radio transmitter uses one transistor only. Its other features are: (a) very low current drain (about 1.5 mA); (b) it works well even without any aerial (this doesn't mean that its performance with an aerial would not be better); and (c) all the components, except the loudspeaker (used as microphone), can be housed in a match box size enclosure.

The heart of the transmitter is the only transistor (BF194B) which serves as many as three purposes, viz, (a) generation of RF carrier wave as an RF oscillator; (b) amplification of the audio signal coming from loudspeaker (LS) (here used as moving coil microphone) like an audio frequency amplifier; and (c) amplitude modulation of the RF carrier wave with the incoming audio signal as a modulator.

The audio signal from the microphone (LS) is fed to the base of the transistor for amplification. The collector of the transistor is connected to the resonant circuit. To continue the oscillation, a positive feedback is provided in a way similar to that of the local oscillator of superheterodyne radio receiver. The RF wave generated in this way is modulated in amplitude by the amplified audio signal. This amplitude modulated RF wave can be received by a nearby AM radio receiver tuned to the frequency of the emitted RF wave. The frequency of the emitted RF wave can be changed by varying the capacitance of VC1 (one section of a 2X gang).



Don't forget to insert a ferrite rod inside the antenna coil. Place the receiver about a metre or two from the transmitter and tune the receiver near the high frequency end of the MW band where no station is being heard. Now rotate the gang of the transmitter until you hear a hissing sound in the receiver.

The radio receiver should not be kept so close to the transmitter that it can cause unwanted feedback from the loudspeaker of the receiver to the microphone of the transmitter and break into spurious oscillation thereby producing a shrill noise. If a shrill noise is heard, increase the distance between the receiver and the transmitter until the noise subsides.

Now speak over the microphone (loudspeaker) of the transmitter and feel the thrill of hearing your own voice in the radio receiver!

This transmitter can be used for very short distance communication, say from one room to another, as an intercom. The range of this transmitter may be increased to some extent by connecting an aerial to the collector of the transistor through a capacitor of the order of 100 pF.

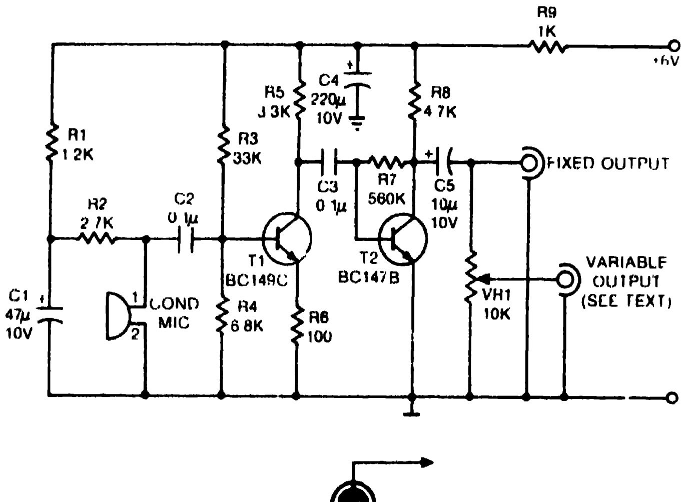
A small 6cm dia., 8-ohm permanent magnet loudspeaker fitted in a wooden cabinet is recommended for use as the microphone.

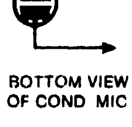
ANINDYA SUNDAR DHAR

Condenser Mike Amplifier

Need often arises for a sensitive sound pick-up device, whether it is to be used as a simple microphone or a more exotic device as a sound operated alarm, a bugging device or a sound operated flash (for stop action photography) - the list is quite unending.

The circuit given employs a condenser microphone as the transducer. Since output of the condenser microphone is quite low, it usually has an FET amplifier built into the case.





BOTTOM VIEW
OF COND MIC

This amp is powered by the R1, R2 resistor network.

The output of condenser microphone is fed to a two-stage amplifier. Transistor T1 (BC149C) utilising current series feedback forms the first stage. The second stage comprising transistor T2 (BC147B) is connected in the voltage shunt feedback configuration. These two stages provide sufficient gain to pick up even the slightest whisper.

The circuit requires a 4.2-volt supply. This may be obtained, as in the prototype, with a 1k (R9) resistor as shown in the diagram. The value of this resistor may be altered to suit a supply voltage other than 6 volts.

Output of the microphone amplifier can be made variable by connecting a 10k potentiometer/preset as shown.

Lab Note. Circuit's gain can be increased by reducing the value of R6 to 47 ohms or 22 ohms, depending on the input sensitivity of the main amplifier system. Increase in gain was also observed by using 3V supply and eliminating R9 altogether. The microphone should be housed in a small round enclosure.

VIVEK MEHRA

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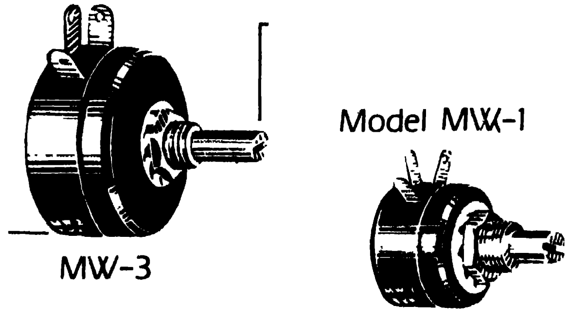

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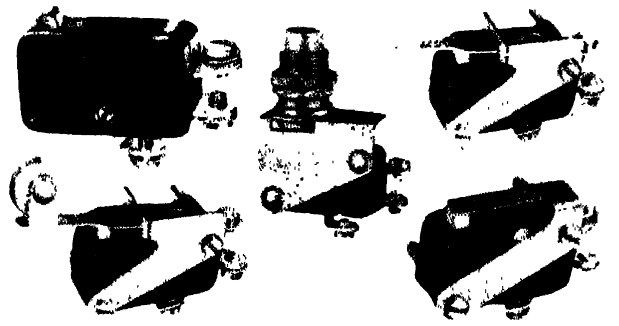

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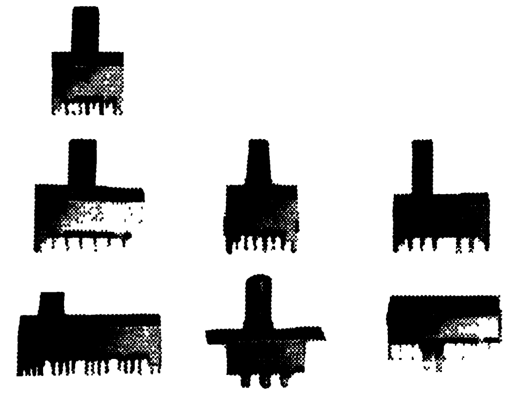

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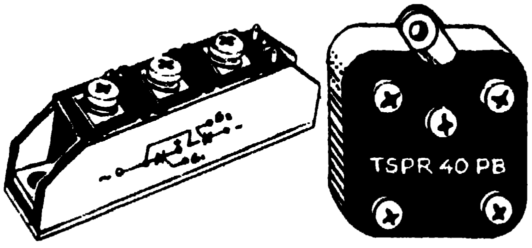

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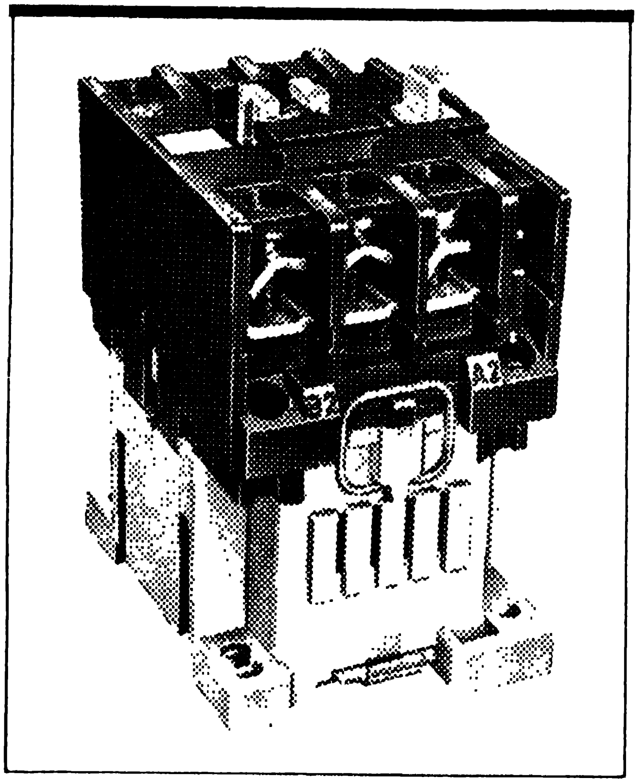

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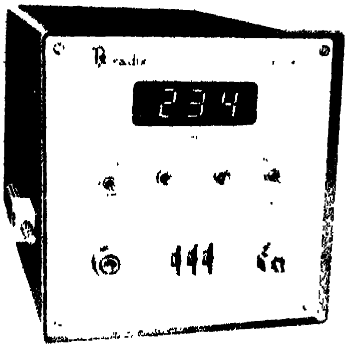

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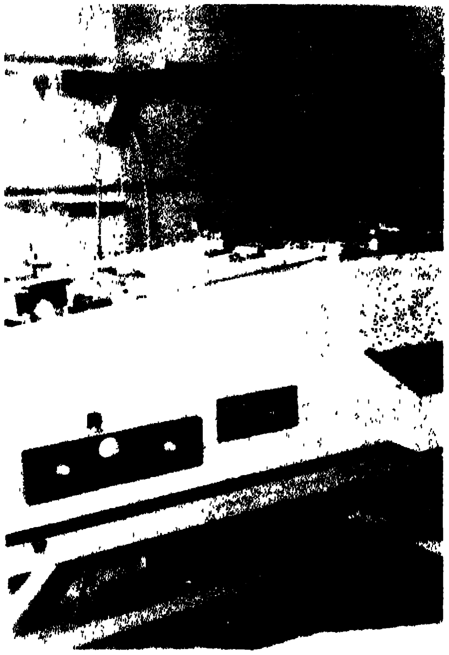
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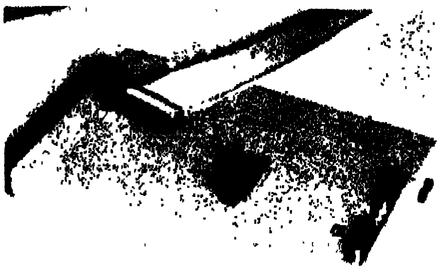
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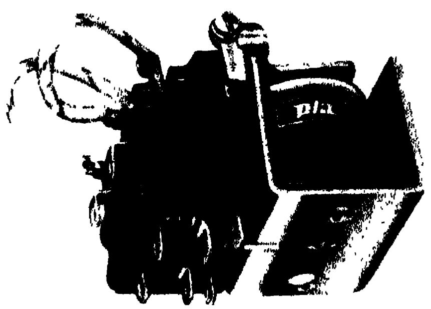
The different ranges offered are 0 to 9999, 0 to 19,999 and 0 to 99999 RPM. These can be connected with any type of pick-up—optical, magnetic or proximity. Accuracy is of the order of ±0.1 per cent FSD. These are handy and can be used even at minute places for RPM monitoring, and are supplied as battery operated portable systems. Also panel mounting type tachometers operated on 230 ±10 per cent volts, 50±3 per cent Hz can be supplied.

DIGITAL TACHOMETER

Contact: Tiger Management Services, No. 10, Apparsamy Koil Street, Mylapore, Madras 600004.

POWER RELAYS

PLA series 'P' Power Relays are available with 1, 2 and 3 C/O contacts rated for 25 amps duty with coils suitable for AC/DC voltages up to 240 volts. These are ideally suitable for high-power duties and can replace contactors. These relays are also approved by CIL for use in defence applications.

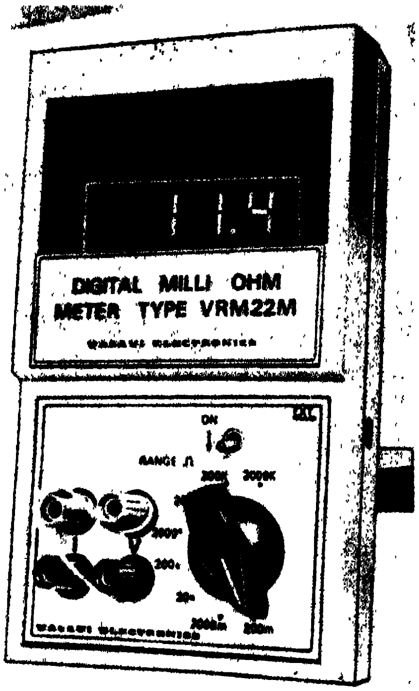


POWER RELAYS

Contact: Sai Electronics, Thakor Estate, Kurla Kirol Road, Vidyavihar (West), Bombay 400086.

DIGITAL MILLI-OHM METER

Vasavi Electronics' Digital Milli-ohm Meter model VRM22M with its four-terminal measurement and 0.1 milli-ohm resolution, makes low resistance measurement very simple and accurate. Being battery/mains operated and light weight, it can be carried to the work spot instead of getting the job near to fixed bridges. It has 3½-digit, 1.27cm bright LED display which is ideal for both factories and laboratories.



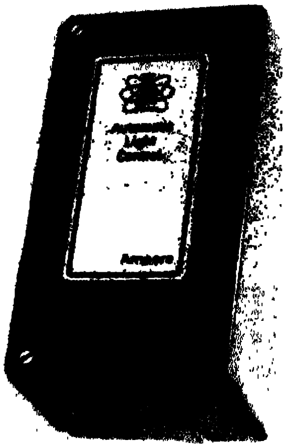
DIGITAL MILLI-OHM METER

Contact: Vasavi Electronics, (Marketing Division), 630 Alkarim Trade Centre, Ranigani Secunderabad 500003.

LIGHT CONTROL UNIT

IEC's Instaswitch is basically an automatic Light Control Unit. It switches lights on automatically when the intensity of ambient light falls below a preset level. Conversely, it switches lights off when ambient light intensity exceeds a preset threshold.

Since the switch is based on the ambient light intensity (and not on some preset times as in timer-based switches), seasonal variations in sunrise and sunset times are conveniently accommodated by this unit. It is available in two basic versions: outdoor and indoor, with a choice of load ratings varying from 10A to 50A. Thus a single outdoor unit can operate up to six street/factory lights.

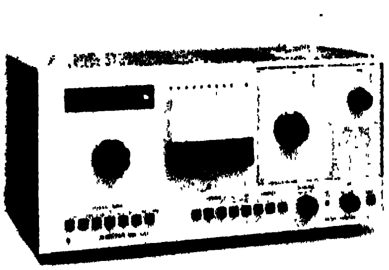


LIGHT CONTROL UNIT

Contact: Indian Engineering Company, Post Box No. 16551, Worli Naka, Bombay 400018.

Q-METER

Q-Meter type MQ-1601 is manufactured by Khatau Engineering Services for measurements of the figure of merit, Q, of inductors and capacitors. Effective values of inductance, capacitance, resistance, distributed capacitance and high frequency cables can be determined. The overall frequency range is from 15.5 kHz to 50 MHz settable with use of a



Q-METER

six-digit counter display.

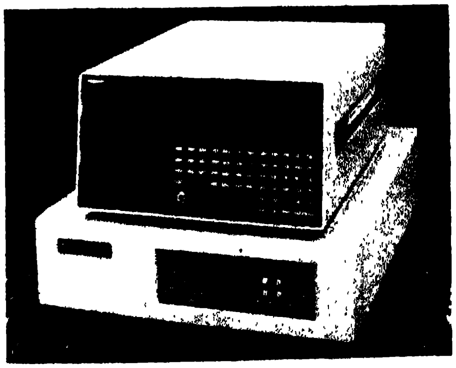
Some of its salient features include: residual inductance less than 10nH, an advantage in high Q measurements and for higher accuracy; highly stable Q voltmeter circuit used for accurate measurements of low Q values; pushbuttons used for frequency and Q ranging; delta Q function provided for measuring small changes in Q, and convenient Q limit setting with lamp indication for quick sampling, checking and inspection.
Contact: Khatau Engineering Services Pvt Ltd, Post Box No. 2910, 43 Krishnanagar Industrial Layout, Dharmaram College Post, Hosur Road, Bangalore 560029.

DIGITAL FUNCTIONAL IC TESTER

Microtek International Inc., Taiwan introduces Digital Functional IC Tester MATE TC 2000 which is programmed to test 1600 devices 54/74 TTL and high speed CMOS, 4000, 1800 CMOS, 55/75 TTL with maximum 20 pins. The tester incorporates key features like loop test for detecting intermittent or temperature related failures and autosearch to identify unknown ICs. Multiple self-diagnostics and built-in overload protection ensure proper functioning of the tester with accurate results.
Contact: Emco Electronics, 106 Industrial Area, Sion, Bombay 400022.

DATA ACQUISITION SYSTEM

Solartron's Data Acquisition System has a capacity to handle 6 Orion data loggers—a total of 3600 data input channels and with any Orion located up to 1200m from the computer. The system is able to measure from a wide variety of sources: voltages, current, resistance, status, events, period and frequency. Furthermore, specific transducers, for example PRTs, strain gauges, thermocouples, pressure, flow and speed can all be measured with ease and directly processed into effective information by the Orion.

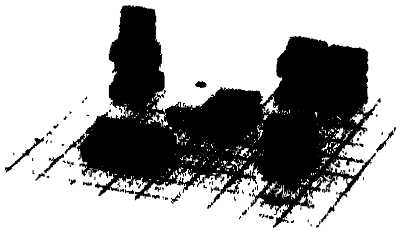

DATA ACQUISITION SYSTEM

This can incorporate both Solartron's alpha and delta range of data loggers. By using the Orion delta, with its built-in BASIC programming language, this system is further enhanced by providing even greater flexibility in the reduction of data. Walking window averaging, cross-channel calculation and enhanced decision-making enables Orion to operate with minimum computer supervision.

Contact: Hindustan Instruments Limited, 603 Vishal Bhawan, 95 Nehru Place, New Delhi 110019.

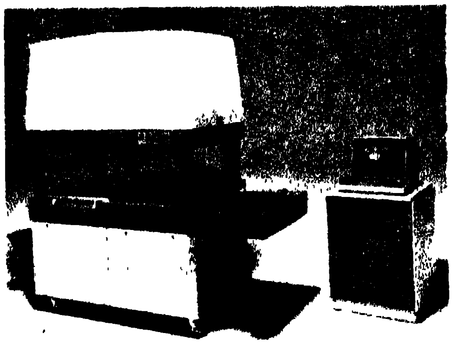
PUSHBUTTON SWITCHES

The new MSL series of Pushbutton Switches from ITT, Schadow has been designed to be flow soldered and washed as a normal part of the assembly process. The sealing protects the switch from contaminants and is compatible with normal washing procedures
Contact: Jost's Engineering Company Limited, 60 Sir Phirozeshah Mehta Road, Bombay 400001.


PUSHBUTTON SWITCHES

MICROGRAPHICS SYSTEM

Terminal Data Corporation Inc., USA has introduced Documate III, the most advanced Microfilm System for 16mm and microfiche. This system, controlled by a microcomputer, can provide virtually any microfiche format at high resolutions. Through a series of sensors, the document to be converted to microfilm or microfiche moves to the desired space, shoots ahead, turns over, and returns to filming of the other side and shoots out—all this in 1.4 seconds.


MICROGRAPHICS SYSTEM

Geared for high volume, high quality microfilming, it is the micrographic view of the 21st century.
Contact: Image Microforms & Systems Pvt Ltd, Era, 123 Mahatma Gandhi Road, Bombay 400023.

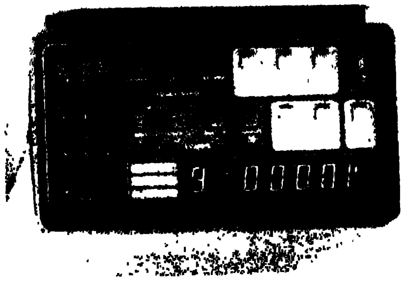
PCB ASSEMBLY SYSTEM

Assembly Automation Limited, UK has introduced Litescan 2000 error free Printed Circuit Board Assembly System consiting of a main projection unit containing an optical module and its electronic control and drives. It incorporates an assembly jig, or alternatively it will accept any standard jig of customers' choice.

One or two 60-bin rotary carousels can be used which are indexed from the main unit and incorporate LED level indicators. The 64 separate LED outputs can be used to indicate either DIL lane positions or extra static bins. Its flexibility permits the system to be set up for either right or left hand operation.
Contact. Aarkay Associates, 818, Sector 16-D, Chandigarh 160016.

PROGRAMMABLE CURRENT SOURCE

Keithley has introduced a new Programmable Current Source model 224. Its specifications include: ±5 nA to 101mA DC output, 10-ohm output resistance, five programmable current ranges, auto increment/decrement, and ±1V ±105V programmable V-limit.
Contact: Micronic Devices, 403 Gagan Deep, 12 Rajendra Place, New Delhi 110008.


PROGRAMMABLE CURRENT SOURCE

DESOLDERING TOOLS

Zevac's Desoldering Tools model PCBRM 10 Air Vac provide a strong and constant suction flow resulting in quick desoldering of multi-lead components like ICs, relays, connectors etc and avoids clogging of the tools. Different types of desoldering systems are available for various applications.
Contact: Arun Electronics Pvt Ltd, Mistry Mansion, 107 M.G. Road, Bombay 400023.

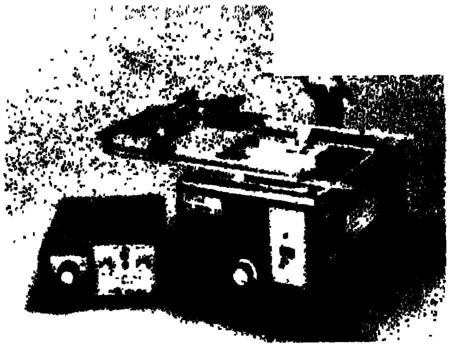

DESOLDERING TOOLS

IMAGE PROCESSING MODULES

Imaging Technology Inc, USA, has introduced single board real time Image Processing Modules, plug compatible with VME bus, multibus, Q-Bus and IBM personal computers It contains 512 × 512 × 12 bit frame memory to store digitised images, and capable of processing the digital images in real time, and displaying the stored image in monochrome or pseudo colour It also has advanced memory architecture that allows users to randomly access individual pixels from the on-board frame memory at extremely fast rates Other important features are eight bit analogue-to-digital converter for digitisation to 256 levels of gray, hardware zooming by factors of 2 4 or 8, transparent look up table access 16 look-up tables per output channel

Contact Electronics Unlimited, G 65 New Cloth Market Ahmedabad 380002

TROUBLESHOOTING TOOLS

Huntron USA offers Portable Troubleshooting Tools - the tracker and its companion interface, the switcher These tools quickly locate digital, analogue, and hybrid circuit solidstate component failures in-circuit and power-off Trackers use a current limited sinewave voltage injected across two points of any device under test The resultant signature is displayed as a current and voltage relationship on the CRT of the tracker. Straight lines and well-defined junctions indicate healthy semiconductor conditions. Curved lines and poorly-defined junctions indicate excessive leakage. Its power rating is 115V AC or 220/240V AC, 80 Hz

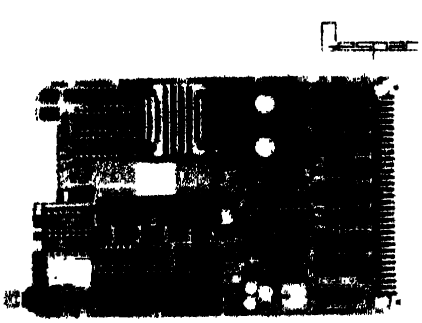
TROUBLESHOOTING TOOLS

The tracker will help to provide better service for computers, peripherals, small business systems, telecommunications and industrial control equipment

Contact Tech Centre, 17D, Pocket IV, Mayur Vihar, Delhi 110091

MODULAR MICROCOMPUTERS

Gespac, Switzerland offers more than a hundred different board-level microcomputer products in their G-64 family It offers a choice of 8, 16 and 32-bit CPUs and a family of 15 processor boards incorporating the M6802, 6809, 68000, Intel 8085, 8088, 8087, Zilog Z80, Digital J11 and National 16032 chip sets. There are 11 memory boards, 21 interfaces, 21 controllers and 30 other types of function boards to choose from Complete software support including CP/M, OS-9 operating system as well as full development microcomputer systems are also available. These boards are all based on the euroboard format of single width PCBs of 10cm × 16cm.



MODULAR MICROCOMPUTERS

The use of such standard modular building blocks or 'macro-components' greatly reduce the project completion cycle in industrial and scientific projects

Contact. Systems & Software, 910/911 Dalamal Tower, Nariman Point, Bombay 400021.

IC SOCKETS

Aries Electronics Inc , USA offers IC Sockets in different types such as DIP type, bifurcated contact, collet contact, wire-wrap contact, round sockets (to sockets), verti sockets, elevator sockets to solder the displays, DIP headers and covers, adjustable programmers, jumpers, shorting links, jacks, zero insertion force sockets, eject sockets, single-in-line sockets, pin grid array sockets, DIP switches, connectors etc

Contact Echbee Corporation, Kamer Building, 5th Floor, 38 Cawasji Patel Street, Fort, Bombay 400001

CUT-ONLY TOOLING KIT

Wybar Lead Formers introduce a new Cut-Only Tooling Kit for use on Model SF-100, hand-operated component lead cutting and forming machine

CUT-ONLY TOOLING KIT

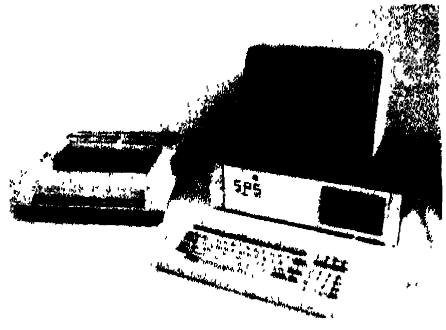
This is designed to cut axial lead components such as resistors, diodes, etc and bend the legs at 90° With this new kit, it is possible to cut the component leads to length without forming them and to cut one leg to length and the other leg to 90° to produce a vertical mounting configuration.

It may be used with either taped or loose components. Production rates of up to 40,000 pieces per hour are possible It takes only a minute to install on the model SF-100 and be in production.

Contact: Wybar Lead Formers, P.O. Box 4961, Vincent Drive, Syracuse, New York 13221, USA

MICROSYSTEM

SPS Microsystem from TBB Hofmann, W. Germany is a very powerful and flexible unit designed for multipurpose applications in industries, teaching and offices. Its salient features are 6809 Motorola CPU, 64k byte on-board RAM, expandable up to 600k byte RAM, I/O ports, serial and parallel interfaces, CRT monitor with a detached keyboard, two double sided/double density 13 3cm floppy disc drives and an optional winchester disc drive.



MICROSYSTEM

Contact: TBB Hofmann, Marienstr. 4, D-8035 Gauting/Munich, West Germany.

ROBOT CONTROL SYSTEM

Kombinats' Industrial Robot Control System Ursalog 5021 is ideal for spray painting and coating When used with basic cinematic unit IFA TR10, it can control cinematic systems that have up to eight degrees of freedom (axes), potentiometric measuring systems and a hydraulic drive.

In the operational system a number of service programmes have been implemented which in case of trouble enable the operating and service personnel via alphanumeric air-conditioning indication and keyboard to rapidly detect and eliminate faults. It releases internal and external processes which are simultaneously coordinated and monitored. This ensures special flexibility and thereby the re-equipment of the control system at a later date and adaptation to other basic cinematic units.

Contact: Kombinat VEB Elektro-Apparate-Werke Berlin-Treptow, "Friedrich Ebert" DDR-1193 Berlin, Hoffmannstrass 15-26.

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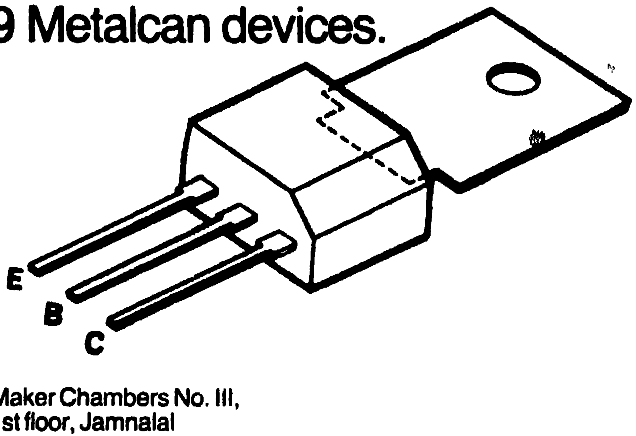

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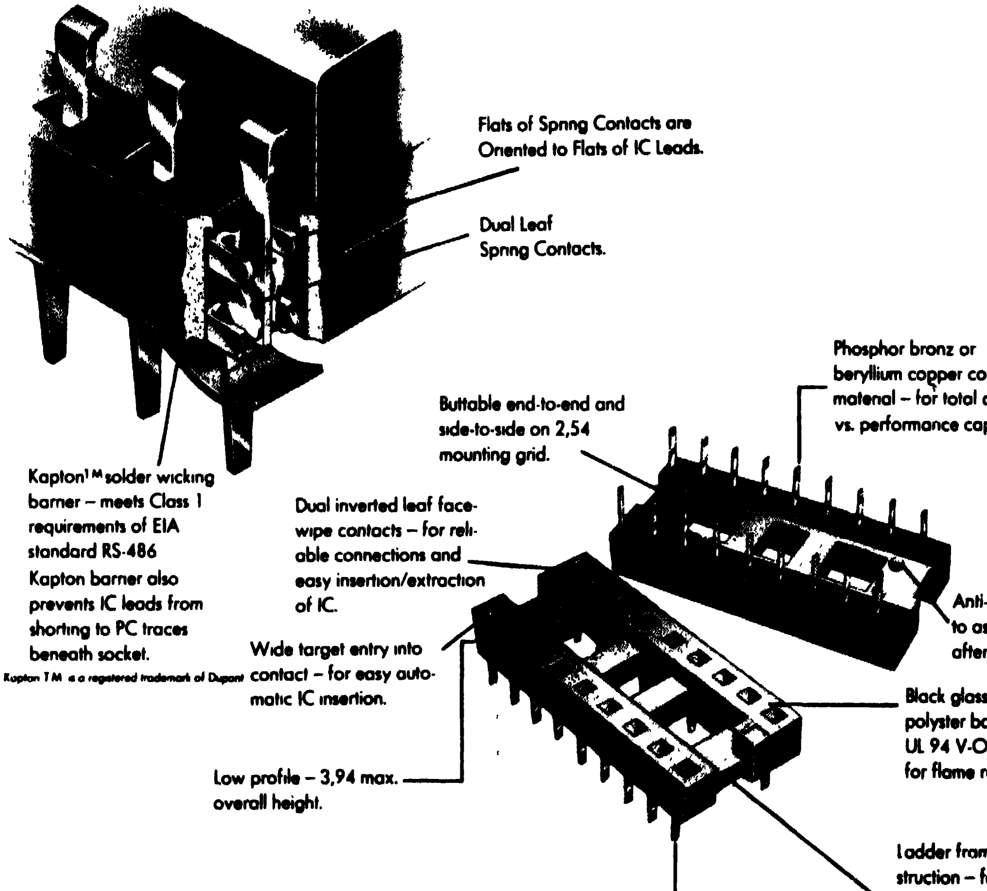

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Buttable end-to-end and side-to-side on 2,54 mounting grid.

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Dual inverted leaf face-wipe contacts – for reliable connections and easy insertion/extraction of IC.

Wide target entry into contact – for easy automatic IC insertion.

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Ladder frame body construction – for improved airflow around IC and visibility of circuit traces on PCB.

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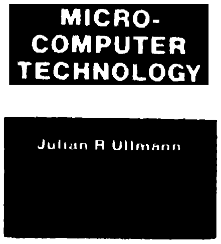
Book Reviews



Microcomputer:

An Introduction

By Julian R. Ullmann; published by A.H. Wheeler & Co. Pvt Ltd, Allahabad; pages 268 (16 cm × 23 cm); soft cover.

This book imparts essential elementary knowledge and skills in logical design and assembly language programming for different levels (1-10) in computer technology. Chapter one explains radix conversation and binary arithmetic, instead of merely presenting a catalogue of procedural values. Chapter two concentrates on assembly language programming for Zilog Z80 at level 7. Chapters three and four emphasise cascaded and other repetitive circuits to strengthen the learners' intuitive grasp in preparation of these circuits. Chapter five provides an introduction to CPU design, while chapter six discusses input and output control, and briefly explains the use of microprocessor as a logic circuit component. And chapter seven further strengthens the knowledge about assembly language and machine code for Z80. Also provided are some vitally important text-related exercises in the first four chapters of this book.

Written in a simple manner, the book covers a wide range of topics to meet the needs of students on introductory computer study courses.

—R.G.

Handbook of Remote Control & Automation Techniques (second edition)

By John E. Cunningham and Delton T. Horn; published Tab Books Inc., USA; pages 386 (13 cm × 21 cm); soft cover; price: US $ 13.95.

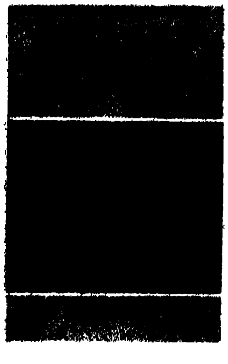
Electronic control systems for the home fascinate the hobbyist as they are both exciting and practical. Here is an ideal guide for those interested in the basic information on the development of remote control and automation technology.

Beginning with the fundamental principles, the book goes on to deal with [illegible] indicators, hydraulic systems and mechanical devices with which an average hobbyist may not be too familiar. Seven chapters are devoted to control devices of various types ranging from simple systems for controlling lights to systems which open doors by remote control.

The dramatic changes made in the field of microelectronics and use of computers as control devices have been particularly emphasised in the book.

The second edition has been considerably updated. Computer controlled systems and overcoming problems in interfacing the described systems with microprocessors have been described in detail. A new chapter explores the latest advances in robotics—including details for experimenters to design their own home-built robots!

—R.B.

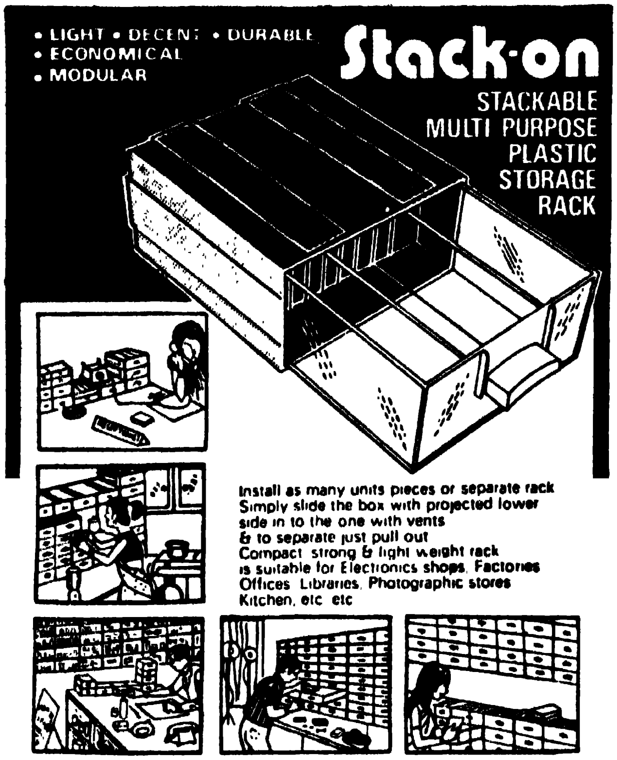


Circuit Theory

By T.S.K.V. Iyer; published by Tata McGraw-Hill Publishing Co. Ltd, New Delhi; pages: 540 (16 cm × 23 cm); soft cover; price: Rs 39.

This book starts with fundamentals and leads to the RC active networks through the methods of analysis and synthesis. Chapters one to three deal with the concept of system function, natural frequency, poles and zeroes for simplifying circuit analysis. Chapter four lays down the basis for mesh-and-nodal analysis through graph theory towards a systematic analysis of larger circuits. In chapter six some network theories, including analogue and duals, are given to simplify circuit analysis, while chapter seven discusses some important properties of network function. Chapter eight focusses on linear electronic circuits by providing knowledge of two-port parameters for the better analysis of these circuits. Chapter ten is devoted to classical theory based on the concept of image impedance while chapter eleven is devoted towards modern filter theory and RC filters. The last chapter concentrates on stable variable method of analysis, including advanced topics in graph theory. Since this book is meant for engineering and physics students, [illegible] to illustrate theory and a set of multiple choices questions and answers are provided for better understanding.

—R.G.



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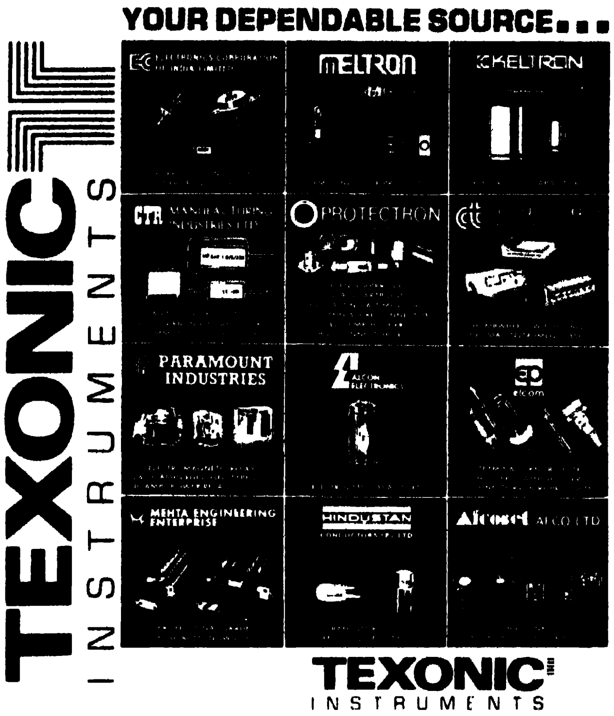

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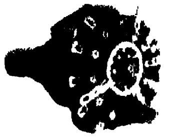

Contact rating 250V AC 500 mA 30VDC 200 mA.. current carrying 2A... Contact resistance less than 10 m ohms... contact made of spring quality Cu Alloy or coin silver... Rotor and Stator—glass filled DAP... various circuit combinations and hardware as per customer's specifications.

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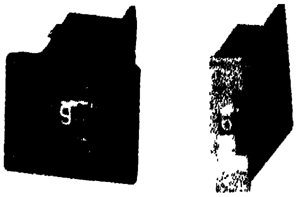

Contact rating 28V AC or DC 125 mA... Contact resistance less than 100 m ohms... Hard gold over Nickel plated PCB's (FR4)... gold plated Beryllium copper wipers... Plastic parts Polycarbonate, Nylon, Acetal etc... Both front and rear mounting types Black and other colours available... BCD, Decimal and other codes available with 8, 10, 16 positions.

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Zehntel's systems are modular and offer a variety of standard features and add-ons including a management information system, a CAD interface, remote diagnostics and networking capabilities.

No wonder world leaders in professional and industrial electronics turn to Zehntel when it comes to board testing – Siemens are using 30 machines and have an equal number on order; IBM use 40 machines and Jeumont Schneider not only use them in their works but have also recommended Zehntel to their EPABX licencees.

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LINTAS M MEL PPG 17 2318

BEL introduces 35.5cm B&W TV picture tube

Bharat Electronics Limited (BEL) has modified its semi-automated TV picture tube plant to produce 35.5cm B&W tubes in a record time. It expects to produce 200,000 to 400,000 TV picture tubes of 35.5cm size per annum. This would be in addition to the production of 400,000 TV picture tubes in 51cm size.

The requirements of black-and-white TV picture tubes in 35.5cm size was hitherto met by imports and another indigenous producers. Decision to convert the second BEL plant was taken in December 1985. Within four months, the plant and equipment for 35.5cm tube production was got ready. The loss of production for the switchcover from 51cm to 35.5cm was confined to one week only. The semi-automated BEL plant is equipped with an industrial robot.

BEL has total expertise in designing and setting-up of black-and-white TV picture tube plants. In fact, it is already implementing an agreement with an entrepreneur for providing, on turnkey basis, a TV picture tube plant with capacity of 500,000 per annum. It has also signed a memorandum of understanding with a state electronics development corporation for providing, on a turnkey basis, another plant of half-a-million capacity per annum.

ITI Mankapur unit set for growth

The digital electronic switching systems unit of the Indian Telephone Industries (ITI), situated at Mankapur in Gonda district of eastern Uttar Pradesh, is a mammoth sophisticated electronic industry being set up at a cost of Rs 1800 million. The unit entered its first phase during 1985-86 and produced 28,000 lines of digital electronic exchange equipment worth Rs 280 million.

During the current year (1986-87), it has planned to produce 120,000 lines of equipment valued at Rs 1080 million. By 1989-90, it will achieve full capacity of 500,000 lines per year with annual turnover of Rs 4000 million.

This unit has been set up on the principle of vertical integration where most of the essential components are produced in-house. This approach was necessary, taking into consideration the extent of infrastructure facility available in the country at the time of conceptualising the project and the fact that since the factory was being set up in a green field area, all critical items had to be planned for in-house production.

The unit has been established in collaboration with CIT-Alcatel of France to manufacture E 10 B type of digital electronic exchanges, thereby laying the foundation for digitalisation of the communication network in India. This unit is one among those which signify a major breakthrough in the technology upgradation efforts of the ITI currently underway.

Gramophone Co. set for expansion

The Gramophone Company of India is offering on a rights basis equity shares worth Rs 22.4 million linked with 15 per cent secured redeemable debentures of Rs 100 each for Rs 57.6 million for augmenting its working capital and to fund its on-going modernisation programme.

The company has decided to utilise its existing assets and manpower by combining modernisation with new activities. The consumer electronic product division is being revamped for manufacturing audio equipment, microcomponent music systems, car stereos and high quality cassettes. It has tied up with Kenwood Ltd, UK for manufacture of domestic and industrial kitchen appliances. The new products are expected to be introduced by October/November 1986

The woodwork division is being geared up for manufacturing TV cabinets and knocked-down modular furniture for the export market. The engineering section is being tooled up for taking up manufacture of auto ancillaries and sophisticated motors. Besides meeting in-house requirements, the printing and packaging division will undertake job work after installation of new offset machines.

Avery India improves performance

Avery India Limited is to manufacture electronic baggage scales and automatic testing equipment at its Faridabad factory in the near future. The company, which recently diversified into the field of electronic machines, is already manufacturing electronic weighing machines, platform scales and balances in collaboration with W and T Avery Limited, UK, and has already bagged orders worth Rs 10 million.

The company has declared a dividend of 35 per cent for the year ended. The dividend declared in the previous year was 30 per cent. Sales turnover in 1985 rose to Rs 256.5 million from Rs 235.2 million in 1984, but profits declined marginally to Rs 63 million from Rs 67.5 million.

HMT to set up corporate computer centre

The public sector Hindustan Machine Tools (HMT) is drawing up plans for establishing a corporate computer centre under its master modernisation and technology replacement programmes during the Seventh Plan.

The proposed centre is part of the company's proposal to enhance computer application in manufacturing and material management, computer aided design (CAD) and computer aided manufacturing (CAM). During the Seventh Plan period, Rs 710 million would be spent on modernisation and replacement programmes as against Rs 518.4 million during the Sixth Plan.

The company is undertaking replacement of machinery, wherever necessary, to take advantage of sophisticated control and precision capabilities. It has already installed the latest machine centres for production flexibility.

Hunt for HCL Collaborator

The selection of a foreign collaborator for the public sector Hindustan Cables Limited's (HCL) proposed fibre optic project is to be finalised within the next few weeks. Several firms from Japan, Denmark and Britain have responded to HCL's bid to locate a suitable collaborator for the Rs 300-million project with a substantial foreign exchange component. The project is expected to go into production in 1988-89.

In 1985-86 HCL earned a pre-tax profit of Rs 106.2 million (Rs 90 2 million in 1984-85) on a production of Rs 1665.9

million (Rs 1320 million) and sales of Rs 1790.2 million (Rs 1470 million). The targets for production, sales and pre-tax profit for the current year (1986-87) have been set at Rs 2603.2 million, Rs 2778.0 million and Rs 127.3 million respectively. This seems possible, since the new unit at Hyderabad to manufacture three million kilometres of jelly-filled cables has already started production and is expected to achieve 40 per cent capacity utilisation during the current year.

During the Seventh Plan period the company proposes to invest about Rs 1220 million on various schemes, mostly modernisation schemes, for which funds would be no problem.

Mahanagar Telephone to issue bonds

Mahanagar Telephone Nigam Ltd, which manages the telephone systems of Bombay and Delhi, has plans to offer seven-year public bonds of Rs 1000 each for cash at par for a total amount of Rs 3000 million around August next.

The Nigam might get the government's permission to give graded-priority to bondholders in the matter of sanction of new telephone connections.

The Nigam has, at present, assets worth depreciated value of Rs 12,000 million (Rs 8000 million in Bombay and Rs 4000 million in Delhi). The annual revenue is Rs 3000 million and the low return is mainly because of low telephone and other charges. While the charges have only tripled since 1960, the price index has shot up 14 fold, and the cost of equipment and staff salaries have gone up eight times each. Operations and maintenance account for only 20 per cent of the expenditure, and of this establishment charges total just 15 per cent.

The Nigam has a Rs 120-billion modernisation and expansion plan. It had sought this amount under the Seventh Plan but only Rs 40 billion has been approved and even of that Rs 30 billion is to be from internal resources.

DDC system knowhow for BHEL

Special purpose microprocessor based digital distributed control (DDC) system for power stations and industries will now be manufactured by Bharat Heavy Electricals Limited (BHEL).

A technical collaboration agreement was signed recently by Mr B.S. Samat, chairman and managing director, BHEL and Mr W. Roos, member, board of management, Brown Boveri, Switzerland.

With this the most modern and versatile state-of-the-art microprocessor based distributed digital control systems would be available to the Indian industry for automation in the entire range of applications from sub-system level to complete plant level. The scope of the agreement covers hardware and software design, engineering, manufacturing and supply of 'Procontrol' family of digital, decentralised control and monitoring systems.

BHEL has been supplying controls for various applications in power plants as well as in industry, based on the conventional method of controls. BHEL which had hitherto imported these controls will now manufacture them indigenously. The programmable control system is capable of offering a degree of accuracy, flexibility and versatility in their operations which is not possible by the existing system of hardwired controls, beside improved productivity and availability of plants.

Public issue by Fraternity

Fraternity Electronics Limited went public recently with an issue of 540,000 equity shares of Rs 10 each for cash at par.

The company is manufacturing audio magnetic tapes of international standards. It has also set up India's first magnetic video tape manufacturing unit equipped with the latest hi-tech machinery.

Usha Micro's bilingual computer

In keeping with the government's emphasis on using computers with bilingual capabilities, Usha Microprocess Controls Limited has developed just such a word processor called Devnagri.

The system has the flexibility of upgradation to take care of other languages as well. The software has been developed on the company's own Eagle PC—fully compatible with industry standard IBM PC, with a special effort to maintain its transportability to other systems also. The keyboard design makes operation simple for even the least skilled user.

Creation of Devnagri characters has been amply simplified. The word processor includes features like insert, delete, cursor movement, formatting of text, search/replace, printing etc. All standard features have been covered by Devnagri's flexible design.

The Devnagri word processor will be useful in creating bilingual documents such as letters, reservation charts, creating modifiable information for the masses, dictionary usage and use in government offices.

Large CTV from Weston

Weston Electroniks Limited recently launched the Centron VII—the largest colour television set available in the Indian market. The CTV was formally launched by Mr K. Sugiyana, director, Hitachi Sales Corporation, Japan, with which Weston has close cooperation.

The third generation set will have special features like auto-programme search, auto colour, full function remote control, hi-fi sound, anti-glare screen, besides all other functions of a normal CTV.

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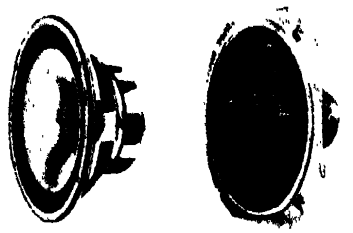

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122, 1st Floor
Sadar patrappa Road
Bangalore 560 002.

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Baroda 390 001.

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For registration please contact:

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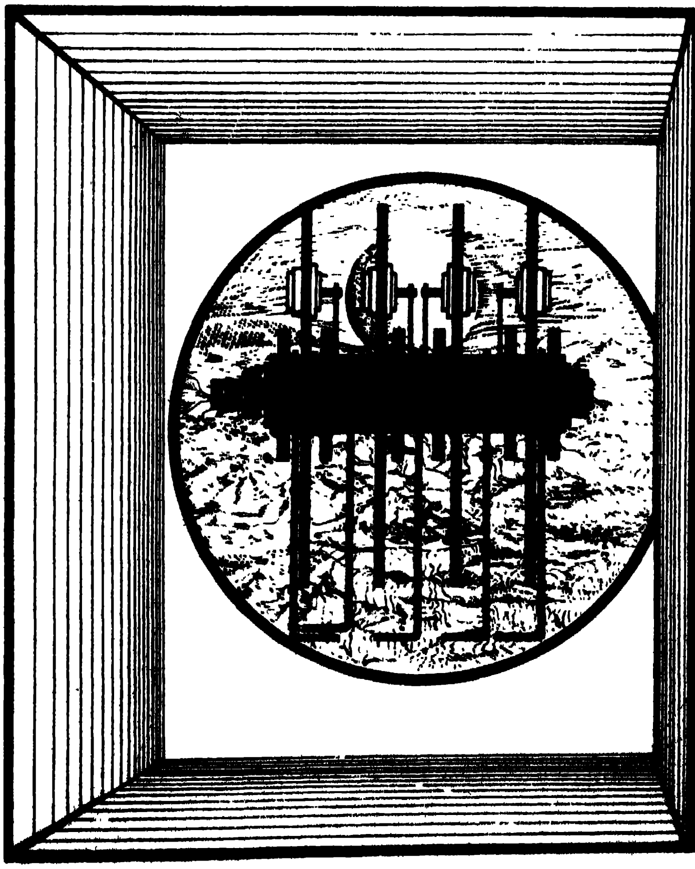

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LICENCES AND LETTERS OF INTENT

The following licences and letters of intent were issued to electronics firms under the Industries (Development & Regulation) Act, 1951 during the month of February 1986.

Name & Address of the Applicant and Location of the Undertaking (1)	Date & Type of Licence (2)	Article (3)	Quantity per Annum (4)
LICENCES			
Dynamic Enterprises Pvt Ltd 181/33 Industrial Area, Phase-I Chandigarh (Chandigarh)	3 2.86 (NU)	Magnetic recording playback and erasing heads	1 2 million nos
The Meghalaya Indl Dev Corpn Ltd 'Kismat', Upland Road Laitum Khrah, Shillong 793003 (Khasi Hills-Meghalaya)	4.2 86 (NU)	Tantalum capacitors	5 million nos
Morris Electronics Ltd Bhosari Industrial Estate, Pune 411026 (Pune-Maharashtra)	5 2.86 (SE)	1 Hard ferrites 2 Soft ferrites	2500 tonnes 1000 tonnes (after expansion)
P. Palaniappan 235 Nint Street, Madras 600003 (Chingleput-Tamil Nadu)	12.2 86 (NU)	Metallised plastic films (capacitor grade)	180 tonnes
Indian Computer Software Co Ltd 808 Siddhartha, 96 Nehru Place New Delhi 110019 (Madras-Tamil Nadu)	13 2 86 (COB)	Computer peripherals dot matrix printers and CRT display monitors	10 million
Jyoti Limited Industrial Area P O Chemical Industries Vadodara 390003 (Vadodara-Gujarat)	21.2.86 (NA)	Programmable logic control systems	75 nos
Peico Electronics & Electricals Ltd Shivsagar Estate, Block 'A Dr Annie Besant Road Bombay 400018 (Agrahara-Karnataka)	25.2 86 (NU)	1 High speed character printers 2. Mini floppy disc drives 3 Low profile electronics keyboards	1000 nos. 2000 nos 1500 nos
Peico Electronics and Electricals Ltd Shivsagar Estate, Block A' Dr Annie Besant Road Bombay 400018 (Pune-Maharashtra)	26.2 86 (NA)	Single-sided printed circuit boards	30,000 sq.m
Uptron India Ltd 10 Ashok Marg, Lucknow 226001 (Lucknow-Uttar Pradesh)	28 2 86 (NA)	Line output transformers for colour TVs	300,000 nos.
LETTERS OF INTENT			
Narendra Kumar Patni 42-A Jolly Maker, Apartment-I Cuffe Parade, Colaba Bombay 400005 (Ghaziabad-Uttar Pradesh)	4 2 86 (NU)	Minicomputer/microprocessor based systems	Rs 200 million
Jyoti Limited Industrial Area P.O Chemical Industries Vadodara 390003, Gujarat (Vadodara-Gujarat)	4.2.86 (NA)	Minicomputer/microprocessor based systems	Rs 20 million
Jawahar Kandhari 29 Vasantanagar, 7th Cross Bangalore 560052 (Bangalore-Karnataka)	4.2.86 (NU)	Minicomputer/microprocessor based systems	100 million
Sundaram Clayton Ltd 'Jayalakshmi Estates' 8 Haddows Road Madras (Karnataka)	14.2 86 (NU)	1. Uninterruptible power supply systems 2 Switch mode power supply systems	21,000 nos. 54,000 nos.
Mahinder Singh Thakural C/o Dr N L Hingorani R J. Consultants Pvt Ltd 3A Meher House, 1st Floor 15 Cawasji Patel Street Fort, Bombay 400001 (Ghaziabad-Uttar Pradesh)	14.2.86 (NU)	1 Minicomputer/microprocessor based systems 2. Computer peripherals 3. Electronic calculators	Rs 100 million Rs 60 million 100,000 nos.
Norsk Data (India) Pvt Ltd Plot No 47, Developed Plots for Electrical & Electronics Industries Seevaram Village, Madras (Chingleput-Tamil Nadu)	21 2.86 (NU)	Minicomputer/microprocessor based systems	Rs 100 million
Bhoruka Data Products Pro. Bhoruka Drum & Allied Trans Industries Pvt Ltd 1010 Raheja Chambers Nariman Point Bombay 400021 (Thane-Maharashtra)	21.2 86 (NU)	1 Computer peripherals (floppy disc drives and printers) 2. CRT data display monitors	Rs 50 million 5000 nos.
Zoom Electronics (India) Ltd D-7 Knollswood, Shimla Himachal Pradesh (Any backward Distt-Himachal Pradesh)	21 2.86 (NU)	1. Portable X-ray machines 2. Digital blood pressure monitors 3 Digital weighing scales 4. ECG machines	500 nos 5000 nos. 5000 nos 1000 nos.
ITL Computers (P) Ltd 86 Srinagar Colony Hyderabad 500873 (Medak-Andhra Pradesh)	21.2.86 (NA)	1. Minicomputer/microprocessor based systems 2 Robotic systems	Rs 100 million 500 nos.
Hindustan Brown Boveri Ltd Brown Boveri House Race Course Circle Vadodara 390007 (Mysore-Karnataka)	21.2.86 (NA)	Facsimile equipment	2000 nos.
Flovel Private Limited 13/1 Mathura Road Faridabad 121003 Haryana (Faridabad-Haryana)	21.2.86 (NA)	Electronic governors for prime movers	1500 nos.
Ambalal Sarabhai Enterprises Ltd (Unit. Systronics) Wadi Wadi, Vadodara 390007 (Ahmedabad-Gujarat)	24.2.86 (NA)	Recording gas chromatographs	150 nos.
The Enfield India Limited 29 Eldams Road, Madras 600018 (North Arcot-Tamil Nadu)	24.2.86 (NU)	1 Black-and-white TV receivers 2. Colour TV receiver sets 3. Mono/stereo-radio-cum-cassette players/three-in-ones other than those reserved for the small-scale sector	9000 nos 50,000 nos. 10,000 nos.
Kody Elcot Ltd 1/6th East Street, Kamarajnagar Thiruvanmiyur, Madras 600041 (Chingleput-Tamil Nadu)	27.2.86 (NU)	1. Defibrillators 2. Cardiac monitors and patient monitoring systems 3. Respirators	150 nos. 150 nos. [illegible]
Belwal Electronics Ltd 16 Duplex Oberoi Apartments 2 Sham Nath Marg, Delhi 110054 (Nainital-Uttar Pradesh)	28.2.86 (NU)	Facsimile [illegible]	[illegible]

Name & Address of the Applicant and Location of the Undertaking (1)	*Date & Type of Licence* (2)	(3)	*Quantity per Annum* (4)
Punjab State Electronics Development & Production Corpn Ltd **Bank of India Building, (2nd Floor)** **Sector-17B, Chandigarh** **(Roper-Punjab)**	**28.2.86** **(NU)**	**1. High powered X-ray machines**	**19 nos**
		2. X-ray therapy simulators	**12 nos**
		3. Linear accelerators (4 MEV)	**12 nos.**
		4. Gama cameras	**12 nos.**
Devilog Systems (India) 65 H. Siddiah Road Bangalore 560002 (Bangalore-Karnataka)	28.2.86 (NU)	Computer peripherals	Rs 60 millior
Kerala State Industrial Development Corpn Ltd T.C. No. XI/239, Keston Road Kawdiar, Trivandrum 695003 (Alleppey-Kerala)	28.2.86 (NU)	Metallised paper	1000 tonnes

LICENCES AND LETTERS OF INTENT CANCELLED/LAPSED

Name of the Undertaking (Location)	*L/IL Dated*	*Article*
LICENCES		
Televista Electronics Pvt Ltd New Delhi (Maharashtra)	31.12.83	Colour TV receivers
Rao Insulating Co Pvt Ltd Bangalore (Karnataka)	25 6 83	Monochrome TV receivers
Unitron Ltd Uttar Pradesh (Haryana)	25.1.85	Black-and-white and colour TV receiver sets
LETTERS OF INTENT		
Yughalakshmi Video Pondicherry (Haryana)	29.12.83	Black-and-white TV receivers etc
Cee Kay Associates New Delhi (Uttar Pradesh)	20.12 83	Colour television sets
Vijay Krishna Lakhanpal New Delhi (Goa, Daman & Diu)	12.3.85	Colour TV receivers
CTR Manufacturing Industries Ltd Pune (Maharashtra)	13.8.84	Cermet potentiometers
S.V. Padmakumar Pollachi (Tamil Nadu)	24.2.84	Electronic typewriters
Home Vision System Pvt Ltd New Delhi (Rajasthan)	13.12.84	Video projectors
R. Vijay Kumar C/o Vikram Enterprises Madras (Tamil Nadu)	27.12.84	VCR/VCP and video projectors
Kinetic Engineering Pune (Madhya Pradesh)	13.12.84	Video projection TVs etc
Mohan Vimal New Delhi (Haryana)	27.12.84	Colour projection TVs
Televista Electronics Pvt Ltd New Delhi (Uttar Pradesh)	12.11.84	Large-screen TV projection systems
Rajaram Ramachandran Bangalore (Tamil Nadu)	22.9.84	VCR/VCP and video projectors
C.H. Krishnamurthi Rao Pondicherry (Pondicherry)	27.12.84	Video/TV colour projection systems and colour TVs
Meenakshi Electronics Ltd Kanpur (Uttar Pradesh)	21.7.84	Colour TV sets
Name of the Undertaking (Location)		
PCS Data Products Pvt Ltd Bombay (Madhya Pradesh)	3.12 84	Colour TV sets
Dr C.L. Chandok Solapur (Madhya Pradesh)	13.12.84	Colour TV sets
M L Tandon Bombay (Karnataka)	24.2 84	CTV receiver sets
Vishnudas Ranglal Bhutada Maharashtra (Madhya Pradesh)	27 12 84	CTV receiver sets
Sarine Electronics Pvt Ltd New Delhi (Himachal Pradesh)	16 7 84	Colour and black-and-white TV sets
Dinesh Jain Cachar (Assam)	27 12 84	Colour TV sets

LIST OF UNITS APPROVED IN THE ORGANISED SECTOR FOR THE MANUFACTURE OF COMPUTERS

Name of the Unit 1	*Item* 2	*Capacity* 3
Ambalal Sarabhai Enterprises Ltd Vadodara	Minicomputer/microprocessor based systems	Rs 60 million/annum
Andhra Pradesh Electronics Dev Corpn Ltd Hyderabad	1 Shared display systems	20 systems/annum
	2 Data acquisition systems	20 systems/annum
Anika Computers Pvt Ltd New Delhi	Intelligent/interactive graphic terminals	100 systems/annum
Aptex Computers Pvt Ltd Bombay	1 Personal computers	5000 systems/annum
	2 Data acquisition systems	5000 systems/annum
ASEA Ltd Bombay	Minicomputer/microprocessor based systems	Rs 20 million/annum
Ashok Kumar Verma Delhi	Minicomputer/microprocessor based systems	Rs 100 million/annum
Auto Control Pvt Ltd New Delhi	Minicomputer/microprocessor based systems	Rs 60 million/annum
Avtar Singh Sethi New Delhi	Minicomputer/microprocessor based systems	Rs 60 million/annum
B. Biswas New Delhi	Minicomputer/microprocessor based systems	Rs 100 million/annum
Basu Joshi Vetteth Madras	Minicomputer/microprocessor based systems	Rs 60 million/annum
Bharat Heavy Electricals Ltd Bombay	Minicomputer/microprocessor based systems	Rs 350 million/annum
Bihar State Electronics Dev Corpn Ltd Patna	Minicomputer/microprocessor based systems	Rs 65 million/annum
Bush India Ltd Bombay	Minicomputer/microprocessor based systems	Rs 100 million/annum
B.K. Aggarwal Houston	Minicomputer/microprocessor based systems	Rs 200 million/annum
Blue Star Ltd Bombay	Minicomputer/microprocessor based systems	Rs 300 million/annum
CHK Data Systems Pvt Ltd Madras	Microprocessor based measure, control systems	Rs 20 million/annum
Chowgule & Co. Pvt Ltd Goa	Minicomputer/microprocessor based systems	Rs 200 million/annum
Computronics (India) Ltd New Delhi	Minicomputer/microprocessor based systems	Rs 20 million/annum
Continental Device India Ltd	Minicomputer/microprocessor	Rs 200 million/annum

Name of the Unit 1	Item 2	Capacity 3
	based systems	
CRID Ltd Bhubaneswar	Minicomputer/microprocessor based systems passbook printers, proof encoders	Rs 60 million/annum
Crompton Greaves Bombay	Programmable controllers	Rs 40 million/annum
D S Nanda New Delhi	Minicomputer/microprocessor based systems	Rs 100 million/annum
DCM Data Product New Delhi	1 Data loggers 2 Minicomputer/microprocessor based systems 3 Data entry systems 4 CRT data/graphic display terminals	100 nos/annum Rs 115 million/annum 400 nos/annum 4000 nos/annum
Debikay Systems Ltd New Delhi	Word processors	20 000 nos annum
Dittakavi Ashoke New Delhi	Minicomputer microprocessor based systems	Rs 100 million/annum
Eacom's Controls (India) Pvt Ltd New Delhi	Process control microprocessor based process instruments	Rs 150 million/annum
Electronic Research Pvt Ltd Bangalore	Minicomputer/microprocessor based systems	Rs 200 million/annum
Electronic Systems Punjab Ltd Chandigarh	1 Minicomputer microprocessor based systems 2 Data aquisition systems 3 Colour graphic terminals	Rs 150 million/annum 20 systems/annum 500 systems/annum
Electronics Corporation of India Ltd Hyderabad	1 Analogue computer systems 2 Digital computor systems 3 Minicomputer/microprocessor based systems 4 Colour graphic/image process display terminals 5 Data acquisition systems	35 50 250 100 Rs 30 million/annum
Electronics Corpn of Tamilnadu Ltd Madras	Minicomputers	50 systems/annum
Emesh Micro Computer International Ltd Chandigarh	Microcomputing devices	10,000 nos/annun
General Electronics	Minicomputer/microprocessor based systems	Rs 20 million/annum
Golden Computers Pvt Ltd Bombay	Microprocessor based systems	50 systems/annum
Goodwill Electronics & Engg Co Pvt Ltd New Delhi	Minicomputer microprocessor based systems	Rs 60 million/annum
Gujarat Communication & Electronics Ltd Vadodara	Minicomputer/microprocessor based systems	Rs 30 million annum
Hindustan Brown Boveri Ltd Vadodara	Minicomputer/microprocessor based systems	Rs 100 million/annum
Hindustan Computers Ltd New Delhi	1 Minicomputer/microprocessor based systems 2 Accounting invoicing machines	Rs 230 million/annum 620
Hinditron Computer Systems & Consultant (P) Ltd Bombay	Digital computer systems	100 systems/annum
Incomnet India Ltd Mohali	Minicomputer/microprocessor based systems	Rs 60 million/annum
Ind Promotion & Investment Corpn of Orissa Ltd Bhubaneshwar	Minicomputer/microprocessor based systems	Rs 20 million/annum
Indian Duplicators Co Ltd Calcutta	Word processing systems	3000 systems/annum
Indo-Swing Ltd Hyderabad	Minicomputer/microprocessor based systems	Rs 100 million/annum
Infotech Ltd Madras	Minicomputer/microprocessor based systems	Rs 60 million/annum
Instrumentation Ltd Kota	1 Data acquisition systems 2 Microprocessor based systems	Rs 60 million/annum Rs 30 million/annum
International Computors India Mfg Ltd Pune	1 2904 computer systems 2 Minicomputer/microprocessor based systems	100 systems/annum Rs 240 million/annum
J&K State Indl Dev Corpn Ltd Srinagar	Minicomputer/microprocessor based systems	Rs 100 million/annum
Jagdish Rai Kappal New Delhi	Microprocessor line of process control instruments	Rs 150 million/annum
Jai Ram Chand Moorjani Bombay	Time sharing terminals	5000 systems/annum
Karnal Electronics & Engg Ltd Vadodara	Microprocessor based systems	Rs 30 million/annum
Karnataka State Electronics Dev Corpn Ltd Bangalore	Minicomputer/microprocessor based systems	Rs 100 million/annum
Kartar Singh Thakral Bombay	Minicomputer/microprocessor based systems	Rs 30 million/annum
Kirloskar Electric Co Ltd Bangalore	1 Winchester disc drives 2 Micro/minicomputers	15,000 nos/annum Rs 100 million/annum
Kerala State Electronics Dev Corpn Ltd Trivandrum	Minicomputer/microprocessor based systems	Rs 400 million/annum
Kothari Electronics & Industries Ltd Madras	Minicomputer/microprocessor basod systems	Rs 300 million
Laltandu Mahapatra USA	Minicomputor/microprocessor based systems	Rs 200 million/annum
M R Narayanan Trivandrum	1 Daisy wheel printers 2 Microprocessor based terminal converters	Rs 50 million/annum Rs 50 million/annum
Machinery Mfs Corpn Ltd Bangalore	Minicomputor/microprocessor based systems	250 systems/annum
Macmillan India Ltd Bangalore	Minicomputer/microprocessor based systems	Rs 100 million/annum
Manchar Lal Tondon Bombay	Minicomputer/microprocessor based systems	Rs 100 million/annum
Meltron Instrumentation Ltd Bombay	1 Minicomputer/microprocessor based systems 2 Minicomputer, graphic/scientific 3 Data acquisition systems	Rs 20 million/annum 15 systems/annum 15 systems/annum
Methodex Systems Pvt Ltd New Delhi	Minicomputer/microprocessor based systems	Rs 30 million/annum
Milan Electronics (P) Ltd Noida	Minicomputer/microprocessor based systems	Rs 95 million/annum
Minicomp Pvt Ltd Bombay	Minicomputer/microprocessor based systems	Rs 20 million/annum
Modi Xerox Ltd Rampur	Minicomputer/microprocessor based systems	Rs 300 million/annum
MP State Industrial EDC Ltd Bhopal	Minicomputer/microprocessor based systems	Rs 140 million/annum
Multitech International Ltd New Delhi	Minicomputer/microprocessor based systems	Rs 200 million/annum
Murphy India Ltd Thane	Minicomputer/microprocessor based systems	Rs 20 million/annum
Negolice Ltd New Delhi	Minicomputer/microprocessor based systems	Rs 65 million/annum
OMC Computers Ltd Pattancheru	Minicomputer/microprocessor based systems	Rs 60 million/annum
P L Raghu Ram Secunderabad	Minicomputer/microprocessor based systems	Rs 60 million/annum
Pramod Kumar Agarwal Bombay	Minicomputer/microprocessor based systems	Rs 60 million/annum

Name of the Unit 1	Item 2	Capacity 3
Peico Electronics & Electricals Ltd Calcutta	Minicomputer/microprocessor based systems	Rs 20 million/annum
Prabhat K. Andlagh New Delhi	Minicomputer/microprocessor based systems	Rs 60 million/annum
Prakash Ambagaonkar USA	Controllers for microcomputers	
Prime Home Computers Pvt Ltd New Delhi	Minicomputer/microprocessor based systems	Rs 50 million/annum
Punjab State Electronics Dev & Production Ltd Chandigarh	Minicomputer/microprocessor based systems	Rs 200 million/annum
RCC Plastics Pvt Ltd Bombay	Minicomputer/microprocessor based systems	Rs 200 million/annum
Rakesh Gandhi New Delhi	Minicomputer/microprocessor based systems	Rs 200 million/annum
Rishi Electronics Ltd New Delhi	Minicomputer/microprocessor based systems	Rs 20 million annum
Sanag Micromotion Pvt Ltd	Minicomputer/microprocessor based systems	Rs 50 million/annum
Sandeep Engineers Pvt Ltd New Delhi	Minicomputer/microprocessor based systems	Rs 100 million/annum
Sandur Electronic Controls & Auto Pvt Ltd Bangalore	Data acquisition monitoring systems	50 systems/annum
Semiconductors Ltd Bombay	Computers	2000 systems/annum
Shourie Copier Pvt Ltd New Delhi	Word processors	5000 systems/annum
Siemens India Ltd Bombay	Data acquisition logging control systems	50 systems/annum
Sigma Engineers Pune	Minicomputer/microprocessor based systems	5 systems/annum
Soumag Electronics Ltd Madras	Microprocessor based information display systems	200 systems/annum
Suresh Srivastava New Delhi	Microprocessor based control instrumentation	Rs 100 million/annum
T S Grewal New Delhi	Minicomputer/microprocessor based systems	Rs 100 million/annum
Tata Burroughs Ltd Bombay	Minicomputer microprocessor based systems	
The General Electric Co of India Ltd Calcutta	Minicomputer/microprocessor based systems	Rs 20 million/annum
The National Radio & Electronics Co Ltd Bombay	1 Data acquisition control systems 2 Minicomputer/microprocessor based systems	17 systems/annum Rs 60 million/annum
UP Electronics Corpn Lucknow	1 Keys to disc entry systems 2 Intelligent terminals 3 Operator interface stations	75 150 1000
Unitron Ltd Faridabad	Minicomputer/microprocessor based systems	Rs 20 million/annum
Uptron Digital Systems Lucknow	1 Data loggers for remote telemetry 2. Keys to disc data entry systems 3 Minicomputer/microprocessor based systems	15 systems/annum 150 systems/annum 60 million/annum
Usha Microprocess Controls Ltd New Delhi	Minicomputer/microprocessor based systems	Rs 60 million/annum
Vishy Harihara UK	Minicomputer/microprocessor based systems	Rs 200 million/annum
Webel Business Machines Ltd Calcutta	Computer based electronics industrial monitoring and control systems	50 systems/annum
Webel Computers Ltd Calcutta	Minicomputer/microprocessor based systems	Rs 20 million/annum
Western India Electors Ltd Pune	Data retrieval terminals	2500 nos/annum
Wipro Information Technology Ltd Bangalore	Minicomputer/microprocessor based systems	Rs 400 million/annum

Source From questions answered by the minister of state for Science and Technology, Mr Shivraj V Patil, in the Lok Sabha

ITEM-WISE PRODUCTION OF ELECTRONIC WATCHES FOR THE YEAR 1985

Name of the Manufacturer	Item details	Quantity
Electronics Corporation of Tamilnadu Ltd Madras	Digital electronic watches	6096
Hindustan Machine Tools Bangalore	Quartz watches	163,000
Hyderabad Allwyn Ltd Hyderabad	Quartz analogue watches	94 022
Keltron Crystals Ltd Cannanore	Digital electronic watches	3896
RIICO (Watch Assembly) Ajmer	Digital electronic watches	3708

Source From questions answered by minister of state for Science and Technology, Mr Shivraj V Patil, in the Lok Sabha

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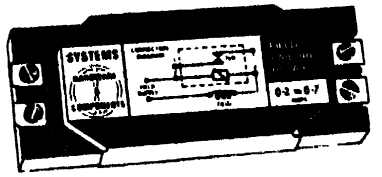

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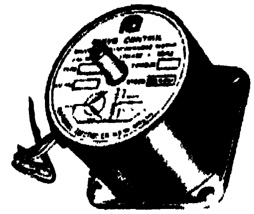

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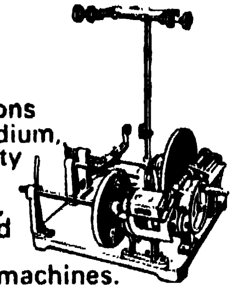

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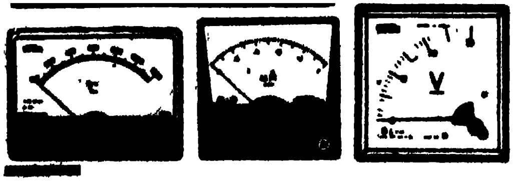

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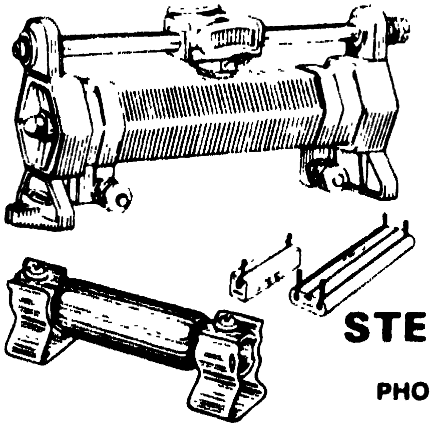
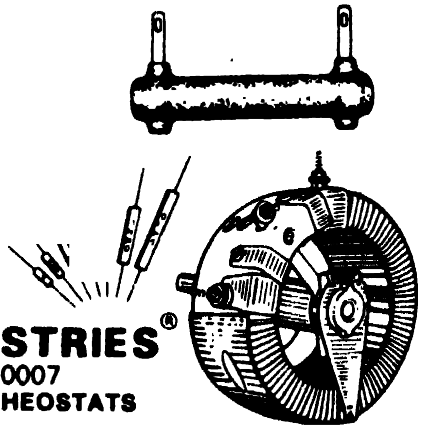

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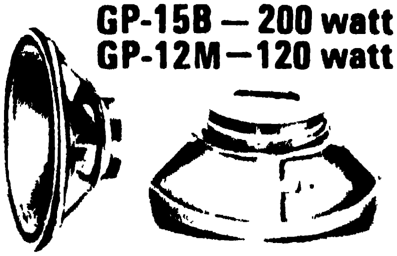

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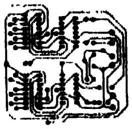

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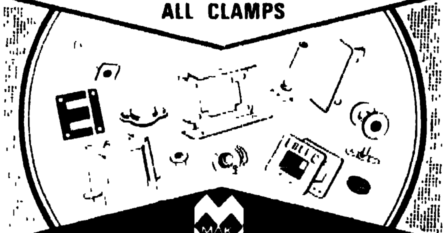

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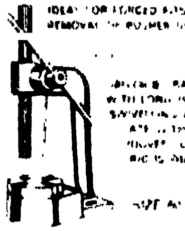

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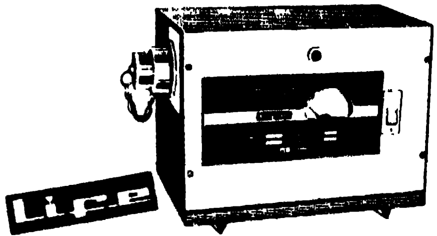

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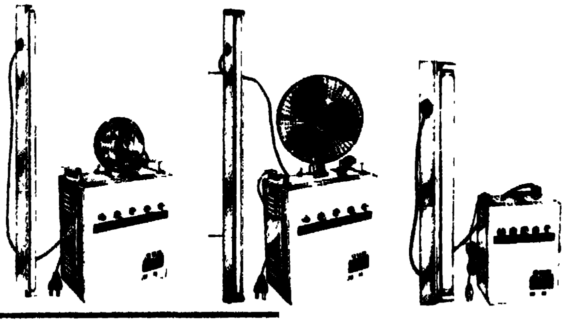

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3	3 Band Radio Receiver 'L Boards	4	145
4	3 Band Radio (using TBA 810 IC)	4	150
5	Coilless Radio Receiver	8	200
6	FM Receiver	9	-
7	Bel TV Mark I, II, III & IV	65	1200
8	Telectron TV (B AW)	60	1100
9	Philips Colour TV	100	-
10	Texla (B&W) TV	50	850
11	BEL 700 IC Tape Recorder	9	400
12	TBA 810/CA 810 IC Tape Recorder	8	375
13	LM 1818 Stereo Tape Deck	25	600
14	Transistorised Playback & Recording Stereo	15	500
15	Stereo Cassette Player (7 + 7 watts)	15	200
16	Stereo Cassette Player (20 + 20 watts)	30	350
17	Stereo Cassette Player (30 + 30 watts)	35	550
18	Stereo Cassette Player (50 + 50 watts)	40	750
19	Stereo Cassette Deck (EFY Jan 1985)	25	600
20	Stereo Cassette Copier	30	800
21	TBA 810 IC Audio Amplifier	3	55
22	CA 810 IC Audio Amplifier	5	60
23	7 + 7 watts Stereo Amp (TBA 810)	6	110
24	TDA 1010 10 watts Audio Amp	4	75
25	10 + 10 watts Stereo Amp (TDA 1010)	8	150
26	20 W Power Amp Mono (TDA 2020)	8	75
27	20 + 20 W Stereo Power Amp (TDA 2020)	10	150
28	20 + 20 W with LM 741 Pre-Amp Stereo	20	250
29	20 + 20 watts with Universal Pre-Amp	25	300
30	7 + 7 watts with LM 741 Pre-Amp	16	225
31	Philips 15/25 watts Power Amp	7	160
32	Philips 40 watts Power Amp	5	175
33	Philips 40 + 40 watts Power Amp (Stereo)	10	350
34	Philips 40 + 40W Stereo with Uni Pre-Amp	25	525
35	30 + 30 watts Stereo Amp (IC STK 439)	20	400
36	Edwin 40 watts Power Amp (Mono)	10	200
37	Edwin 40 + 40 watts Stereo Power Amp	20	400
38	Edwin 40 + 40 watts Stereo with Uni Pre-Amp	32	550
39	50 + 50 W or 100 W Mono LM 391	15	400
40	50 + 50 watts Tr Stereo Power Amp	20	450
41	50 + 50 W Tr Stereo with Uni Pre-Amp	35	600
42	100 + 100 watts Power Amp Stereo	20	650
43	100 + 100 W Stereo with Uni Pre-Amp	35	850
44	100 watts Guitar Amplifier	20	
45	Car PDM Amplifier (10 watts)	10	
46	4 watts Car Radio Amplifier	8	
47	Hi-fi Stereo Head Phone Amplifier	8	-
48	15 watts Bridge Amplifier for Cars	15	
49	TBA 810 with Bass, Treble & Volume	7	75
50	Philips Universal Pre Amp L & R	12	200
51	Hi-fi Stereo Pre Amp	20	300
52	Active Tone Control & Pre-Amp Stereo	5	100
53	LM 387 Universal Pre-Amp Stereo	12	150
54	LM 741 Tone Control Bass, Treble Presence	7	150
55	General Purpose Pre-Amplifier LM 382	5	100
56	Mixer Pre-Amplifier	10	
57	Four Input Mixer	10	
58	Grafic Equaliser 5 Band Mono LM 741	15	225
59	Grafic Equaliser 5 Band Stereo LM 741	25	450
60	Grafic Equaliser 10 Band Mono IC 4136	15	325
61	Grafic Equaliser 10 Band Stereo IC 4136	25	650
62	Noise & Rumble Filter Stereo LM 741	10	100
63	Stereo Rumble Filter	8	50
64	Stereo Balance Indicator	6	50
65	Mono to Stereo Converter	7	100
66	3 Channel Tone Control	6	--
67	Telephone Amplifier	10	175
68	Dynamic Pre-Amplifier LM 387	8	100
69	Stereo Head Pre-Amp LM 741/LM 387/ LM382	5	100
70	Hi-gain Head Pre-Amp UA 749 or 739	8	150
71	Two Transistor Head Pre-Amp Stereo	6	70
72	Stereo Head Pre-Amp LA 3131	5	60
73	Audio Level Indicator 9 LED	5	60
74	Audio Level Indicator 4 LED	3	40
75	Audio Level Indicator LB 1405 10 LED	5	75
76	Audio Level Meter Stereo LB 1405	10	150
77	Digital Clock MKI FND 500	10	325
78	Digital Clock MKII LED	30	400
79	Digital Clock MKIII (5cm DISPLAY)	20	400
80	Small Display (using flat LEDs)	5	40
81	12cm Clock Display Single Digit	20	75
82	16cm Clock Display Single Digit	30	125
83	5cm Clock Display for Clocks 3½ Digits	20	150
84	Musical Alarm for Clock	6	65
85	Analog Clock	20	—
86	Universal Timer (1 sec to 99 hrs)	20	600
87	TV Booster	6	150
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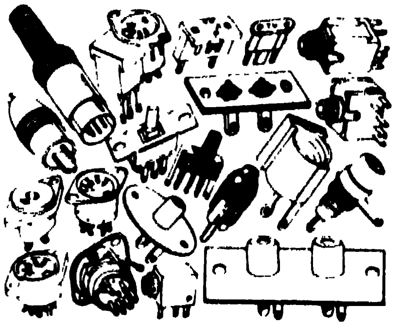

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106	Equipment Closedown Watcher	17	430
107	Analogue Clock 12+12 LED	33	425
108	Digital Clock Display 51 FT LED	10	110
109	75 LED Digital Clock+Alarm	35	430
110	TV/Video Pattern Generator	49	590
111	Inverter 100 W (Freq Control)	17	990
112	Single Phase Preventer	12	230
113	Power Supply & Battery Charger	14	280
114	Digital Combination Car Lock	12	220
115	Car Light Controller	17	130
116	Metal Pipe & Wiring Locator	11	165
117	Electronic Car Ignition	28	590
118	4 to 15V Battery Eliminator	9	110
119	Car Voltage Regulator, Electronic	12	275
120	Digital Capacitance Meter-Design-I	30	710
121	Power Supply 20V-1 5A or 40V-3A	17	350
122	Booster Amplifier for Car Radio	12	165
123	50+50W St Amplifier with PSU	39	900
124	8-CMOS Universal Timer, 1 sec-99hrs	33	780
125	Snooze Timer 5-45 Mins In 9×5m delay	22	210
126	Egg Timer with 2½, 3¼, 5 min Alarm	11	120
127	Light Dimmer with or w/out Light Eff	11	90
128	Fluorescent Light Dimmer	11	110
129	School Boys Short-Wave R Receiver	10	75
130	St Cassette Player (w/out deck)	33	330
131	Four Audio Input Mixer-LM301A	17	250
132	LED Car Engine Temp Indicator	10	100
133	Car Reverse Alarm, Musical	10	100
134	Water Level Controller	15	220
135	1 5W Genl. Purpose 5-TR Amplifier	10	60
136	PEST PESTER Mosquito Repeller	6	40
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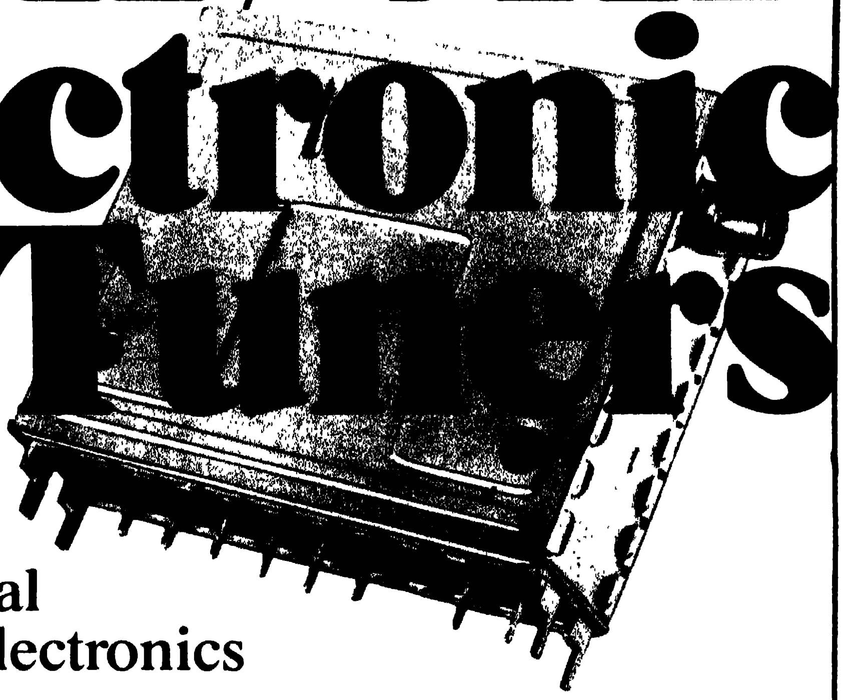

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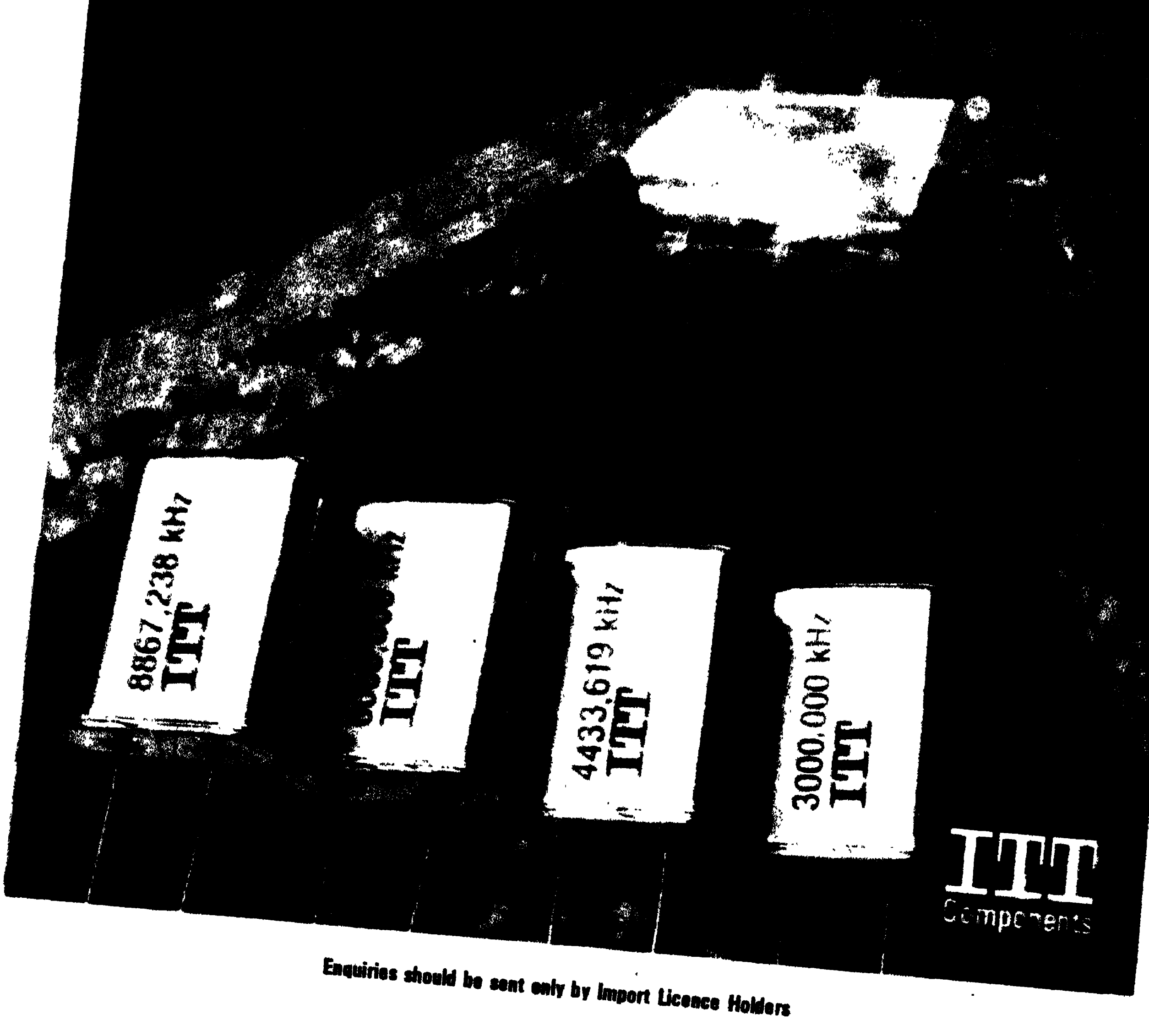

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